ESL-TR-90-323

SELECTIVE AUTOMATIC FIRE EXTINGUISHER FOR COMPUTERS

(SAFECOMP)

DEVELOPMENTAL TEST AND EVALUATION/ INITIAL OPERATIONAL TEST AND EVALUATION

(DT&E/IOT&E)

FINAL REPORT

JANUARY 1990

ENGINEERING & SERVICES LABORATORY
AIR FORCE ENGINEERING & SERVICES CENTER
TYNDALL AIR FORCE BASE, FLORIDA 32403

PREFACE

This report was prepared by Applied Research Associates, Inc. under contract F08635-88-C-0067 (Subtask 3.03), for the Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base, Florida 32403.

A special thanks goes out to the Fire Chiefs, Fire Technical Services, Fire Alarm Technicians, and Computer/Communications personnel for their dedication to the test program at the following participating Air Force Installations: Cheyenne Mountain AFB, Colorado; Eglin AFB, Florida; Gunter AFB, Alabama; Lowry AFB, Colorado; Tyndall AFB, FLorida; Strategic Training Range (SAC), Powell, Wyoming; and the United States Air Force Academy, Colorado Springs, Colorado. Without their efforts a realistic operational evaluation of this unit would not have been possible. A special thanks also goes to the MAJCOM fire staff at ATC, AFCC, AFSC, AU, AFSPACECOM, TAC, SAC, AFESC, and the HQ 1 CEVG for their assistance and support.

CWO-4 Bobby Barrow was the AFESC Project Officer. This report summarizes SAFECOMP tests completed between 24 October 1988 and 30 September 1989.

This test report has been reviewed and is approved for distribution.

Bobby F. Barrow

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14. ABSTRACT

The purpose of this test was to verify the operational effectiveness and suitability of the Selective Automatic Fire Extinguisher for Computers (SAFECOMP) fire detection, suppression and notification system in a realistic operational environment. It is concluded that the SAFECOMP system provides fire detection and suppression inside the computer cabinet without release of a large quantity of fire extinguishing agent. The small amount of Halon 1211 (one pound) in SAFECOMP is safe, leaves not residue and has a very low ozone depletion potential (ODP) of 2.4 per pound as compared to total flood system with hundreds of pounds of Halon 1301 and an ODP of 12. SAFECOMP will replace Halon 1301 total flood systems at an installation and life-cycle cost savings of 90+ percent. The SAFECOMP system has been validated and the performance specifications met. The system has the potential to meet and exceed all of the objectives required for an automatic computer-electronic fire extinguishing system for worldwide Air Force use

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TEST PURPOSE AND BACKGROUND

1.0 TEST PURPOSE.

The purpose of this test was to verify the operational effectiveness and suitability of the SAFECOMP (Selective Automatic Fire Extinguisher for Computers) fire detection, suppression, and notification system in a realistic operational environment.

1.1 AUTHORIZING DIRECTIVES.

HQ USAF Program Management Directive (PMD) Number 2132, Civil and Environmental Engineering Technology, Program Element Number 622104/System Project Number 63723F, provided the authority for this test. HQ MAC/SAC/TAC/ DRAFT SON, HQ AFESC/DEF Letter and Department of Defense (DoD) and Environmental Protection Agency (EPA) provided additional direction for the program. This test program was conducted in accordance with AFR 80-14 and AFR 55-43.

1.2 SYSTEM DESCRIPTION.

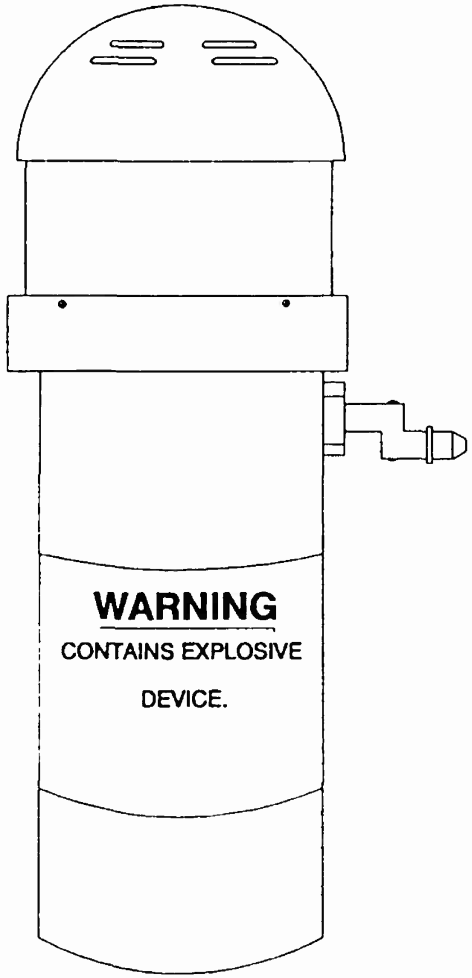
The SAFECOMP system provides fire detection, suppression, and notification in a self-contained, battery operated capsule consisting of four major components and a receiver/transmitter (shown in Figure 1). The SAFECOMP capsule uses a 9-volt lithium battery operated ionization smoke detector, a 16 ounce Halon 1211 replaceable cylinder, a squib activated (pyropneumatic) cartridge, and an 85 dbm (decibel below one milliwatt) audible warning device. This system is designed for installation with a velcro-mounted bracket inside electronic computer cabinets. No holes, wires, or modifications are required. One or more capsules may be installed in each cabinet to provide the 4 to 6 percent concentration of Halon required for fire extinguishment. Cabinets

greater than 42.7 cubic feet would require more than one unit. A wall mounted discriminating receiver/transmitter unit will be wired into the supervisory fire alarm system. The receiver is capable of receiving signals from one or more capsules and transmits a signal to the supervisory fire alarm panel which can be programmed to notify the fire department and phase down computer operations or other systems, as required. The SAFECOMP system components are shown in Figure 1 with the SAFECOMP Operational Concept shown in Figure 2.

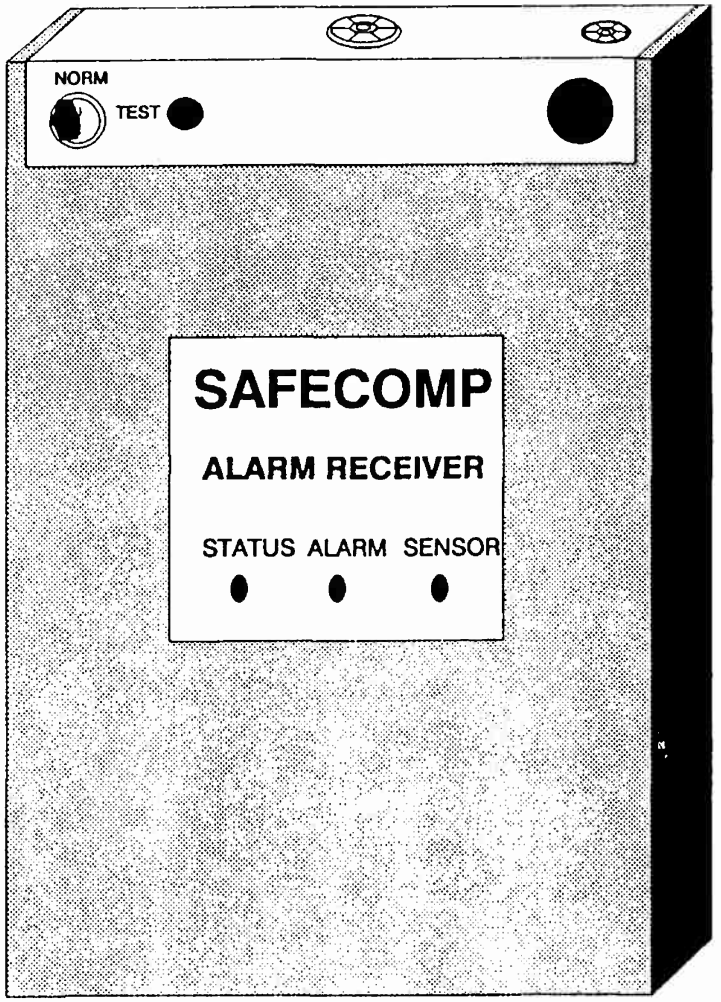
1.3 BACKGROUND.

The Air Force currently uses total flood Halon 1301 and water sprinkler fire suppression systems to protect main-frame computers and other critical high value electronic equipment. These systems are expensive to install and maintain, and cause total disruption of the computer activities when activated. The requirements to reduce cost and increase system reliability led to the development of the SAFECOMP system. The University of New Mexico and the Department of Energy's Oar Ridge National Laboratories cooperated with AFESC's Engineering and Services Laboratory in an effort to design, construct, test, and evaluate the SAFECOMP system. AFESC completed the design concept and provided full scale development of a prototype stand-alone modular device that detects and suppresses fires as close to the fire origin as possible. These units are velcro mounted and require no modification to critical electronic equipment. The SAFECOMP system is designed to provide fire detection and suppression inside the computer cabinet where the greatest potential for fire exists and without the release of a large quantity of fire extinguishing agent. The small amount of Halon 1211 (one pound) in SAFECOMP is safe, leaves no residue and has a very low ozone depletion potential (ODP) of 2.4 per pound as compared in total flood Halon 1301 with hundreds of pounds and an ODP of 12. SAFECOMP will replace Halon 1301 total flood systems at an installation cost savings of 90 + percent.

SAFECOMP SYSTEM COMPONENTS



SAFECOMP
CAPSULE



RECEIVER/TRANSMITTER UNIT

Figure 1. SAFECOMP System Components

SELECTIVE AUTOMATIC FIRE EXTINGUISHER FOR COMPUTER CABINETS (SAFECOMP)

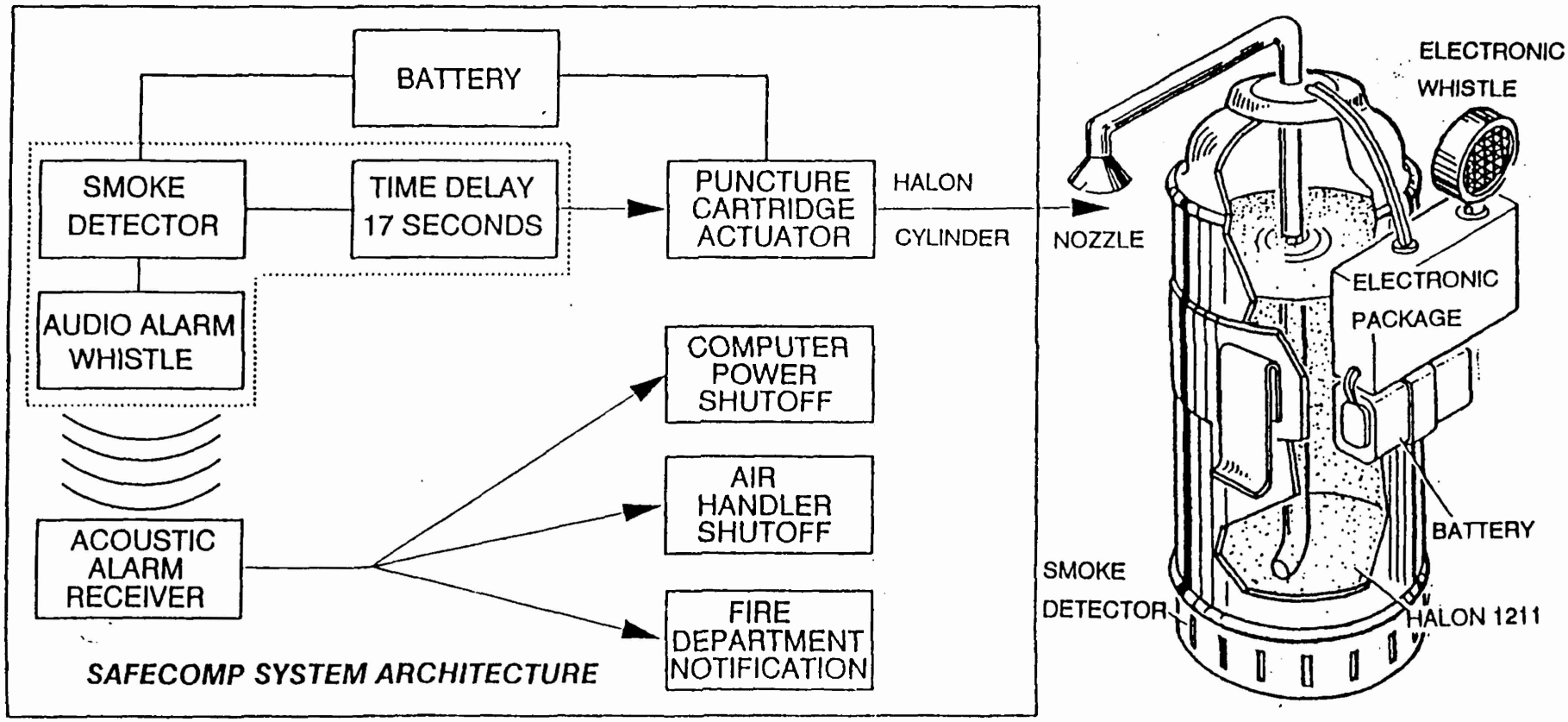


Figure 2. SAFECOMP Operational Concept

PAYOFFS: DETECT FIRES IN INCIPIENT STATE
ELIMINATE HALON 1301 TOTAL FLOOD SYSTEMS
IMMEDIATE FIRE DEPARTMENT NOTIFICATION
RAPID EXTINGUISHMENT/MINIMUM LOSS
REDUCE FIRE PROTECTION SYSTEM COSTS BY 90 PERCENT

Initial evaluation of the prototype models was conducted at Tyndall AFB, Florida in October 87. The AFESC computer area and the Drone control computer facility at Tyndall AFB were protected with SAFECOMP as part of this evaluation. Reference Oak Ridge National Laboratory (ORNL) Technical Report "SAFECOMP" Test and Evaluation Project.

1.4 TEST FORCE, LOCATION, AND DATES

This test program was conducted in three phases at the following locations:

1.4.1 Phase I - Tyndall AFB, Florida - 2 September 1988 - 8 November 1988

TEST NAME	LOCATION/FACILITY
Initial Fire Tests	AFESC Fire Test Facility, Building 21 AFESC Environmental Lab, Building 1117

1.4.2 Phase II - Selected Air Force Facilities - 15 Nov 1988 - 15 May 1989

TEST NAME	LOCATION/COMMAND/FACILITY
Field Tests	Tyndall AFB - TAC/Weapons Evaluation Bldg 1801 Tyndall AFB - AFESC/WANG CPU Bldg 1120-C Gunter AFS - AFCC/Standard System Center Bldg 859 Air Force Academy / Data Processing Center, Bldg 4199 Lowry AFB - ATC/AF / Data Processing Center, Bldg 444 Powell WY - SAC/Radar Unit 1st CEVG Eglin AFB - AFSC/WANG CPU, Bldg 696 Cheyenne Mountain AFB - AFSPACECOM, Bldg 2, Rm 2209

1.4.3 Phase III - Tyndall AFB, Florida - 1 Jun 89 - 15 Sep 89

TEST NAME	LOCATION/FACILITY
Final Fire Tests	AFESC Fire Test Facility, Building 21 AFESC Environmental Lab, Building 1117

1.5 SYSTEM OPERATIONAL AND MAINTENANCE CONCEPT

Pending the satisfactory incorporation of the improvement areas recommended as a result of this DT&E/IOT&E, operationally similar SAFECOMP systems will be an option to the use of total flood Halon 1301 fire suppression systems for protection of computer/electronic equipment from

internal fires. SAFECOMP will become the standard fire protection for computer/electronic equipment.

Essentially, SAFECOMP is a stand-alone fire alarm and suppression system for computer facilities. Base level civil engineering fire alarm servicing technicians will operate and maintain each SAFECOMP unit for this DT&E/IOT&E. Systems will be maintained by the civil engineering craftsmen, computer systems operators, or contract. Systems will require monthly visual inspections, a semi-annual weight check of the cylinder and an annual alarm and transmitter test. The level of maintenance is similar to that of other fire detection systems.

Complete operations and maintenance procedures are contained in the manufacturer's Operations Manual for SAFECOMP. A standard Air Force Technical Order is scheduled for development.

1.6 TEST MANAGEMENT AND ORGANIZATION

The Responsible Test Organization was the Air Force Engineering and Services Center (AFESC/RDCF). The AFESC/RDCF Test Director had total responsibility for the test. Test data collection was the responsibility of the local Computer Operations Manager (Test Site Supervisor) at the seven test locations. The AFESC SETA contractor was responsible for planning conduct and test reporting under the direction of the AFESC/RDCF Test Director.

1.7 TEST PARTICIPANT QUALIFICATION AND TRAINING.

Test participants were Air Force Civil Engineering Fire Alarm Technicians and Computer Systems operators who were familiar with the operation of SAFECOMP system. The required SAFECOMP familiarization training was given at the beginning of the test series by the AFESC/RDCF Test Director.

SECTION II

TEST DESCRIPTION

2.0 GENERAL

The test plan provided the guidelines for operational fire testing of first article SAFECOMP units. In addition, SAFECOMP systems were deployed to seven Air Force units for operational field testing for a period of six months. This test evaluated the reliability and maintainability of the SAFECOMP system in an operational environment. Environmental fire testing scenarios included air movement of 200 cfm and background noise of approximately 85 dbm. Testing was conducted in three phases using AFESC laboratory and fire test facilities for Phase I and III testing. Phase II testing, Field testing, was conducted at seven selected Air Force operational computer and electronic facilities throughout CONUS.

2.1 CRITICAL ISSUES

The following Critical questions concerning the SAFECOMP system were formulated by discussions with operational Air Force fire alarm technicians and computer systems operators/managers. These Critical questions were used in formulating the test objectives, test approach, and test methods.

2.1.1 Does the SAFECOMP system meet the specifications and performance requirements of the AFESC prototype development specification, for physical configuration and low battery alarm?

2.1.2 Will the SAFECOMP unit detect smoke in the incipient stage of a fire?

2.1.3 Will the SAFECOMP unit extinguish a computer fire?

2.1.4 Will the SAFECOMP system receiver/transmitter unit detect the audio signal from one or more SAFECOMP units and properly interface with the facility's supervisory fire detection system?

2.1.5 Can the SAFECOMP system be serviced and maintained when it is operated and maintained by base level civil engineering fire alarm servicing technicians or computer system operators?

2.1.6 Is the technical data provided by the SAFECOMP system manufacturer adequate to permit the unit to be maintained by civil engineering fire alarm servicing technicians or computer system operators?

2.1.7 Does the mean time between critical failure (MTBCF) of the SAFECOMP system meet the 10-year minimum requirement?

2.2 METHOD OF ACCOMPLISHMENT

The test was conducted in three phases to verify all aspects of the SAFECOMP system.

2.2.1 Phase I: Operational fire testing was conducted at Tyndall AFB, Florida, using the fire test facility at building 21. The SAFECOMP system was tested under operational conditions by shorting a transformer to cause smoke and/or fire. Laboratory testing was also conducted at the AFESC Environmental Laboratory (building 1117) at Tyndall AFB. The laboratory testing consisted of igniting electrical wiring and insulation using alcohol as the fuel under a ventilation hood. This series of tests evaluated the SAFECOMP system's capability in fire detection, suppression, and it's interface with the receiver/transmitter unit. An electrical fire may smolder for some time before producing any flame and generate small amounts of heat. The smoke concentration levels varied greatly as a function of the fuel load (electrical wiring) and the heat being generated (power supply). Consequently, the system activation time also varied significantly. The system must detect and extinguish the fire at its source before any significant damage results.

For the purpose of these tests the total fire area was considered to be computer cabinets of 20 to 45 cubic feet. Two classes of fire were of

principal concern. Class "A" being the insulation around the wiring and Class"C" is the wiring itself. A 4 to 6 percent concentration of Halon is required to extinguish fires of this nature.

The notification process was further divided into two separate sections. The local alarm produced by the SAFECOMP capsule was an 85 dbm signal at a preset frequency. The receiver/transmitter was normally wall mounted and interfaced with the facility supervisory fire detection system. Upon activation the receiver/transmitter discriminates between any background noise and the signal and closes an electrical contact to interface with the supervisory fire alarm system.

2.2.2 Phase II: Upon successful completion of the operational test, these SAFECOMP systems were deployed to seven Air Force units. The Test Director accompanied the units to each location, briefed base level personnel on the SAFECOMP system, and provided the required training. Base level personnel installed the units in actual operating computers. All required maintenance and inspections were also performed at base level. Base-level personnel monitored the SAFECOMP systems over the 6-month field test period. A system check and inspection of the installed units was accomplished 3 months after initial installation and at the completion of the test period. Any malfunction, activation, or other discrepancy was included in system reports to AFESC/RDCF. At the completion of the 6-month Phase II test period, all units were returned to AFESC/RDCF, Tyndall AFB, FLorida.

2.2.3 Phase III: Six randomly selected units from the field deployed SAFECOMP systems were retested in the simulated computer fires as described under Phase I testing.

2.3 TEST OBJECTIVES

The overall objective of this test series was to verify the operational effectiveness and suitability of the SAFECOMP system for Air Force use in computer facilities. Objective 1 was a DT&E objective. Test objectives 2, 3 and 4 are DT&E/IOT&E Operational Effectiveness objectives. Test Test Objectives 5, 6, and 7 are Operational Suitability IOT&E objectives.

2.3.1 DT&E and Operational Effectiveness Objectives

a. Objective 1. Verify that the SAFECOMP system meets the specifications and performance requirements of the AFESC prototype development specification, for physical configuration and low battery alarm.

b. Objective 2. Assess the capability the SAFECOMP system to detect smoke in the incipient stage of a computer compartment fire.

c. Objective 3. Assess the capabilities of the SAFECOMP system to extinguish a computer compartment fire.

d. Objective 4. Assess the compatibility of the receiver/transmitter to detect audio signal from one or more SAFECOMP units, and to interface with the facility's supervisory fire detection system.

2.3.2 Operational Suitability Objectives

e. Objective 5. Assess the maintainability of the SAFECOMP system when it is operated and maintained by base level civil engineering fire alarm servicing technicians or computer system operators.

f. Objective 6. Assess the adequacy of the technical data to permit the unit to be maintained by civil engineering fire alarm servicing technicians or computer system operators.

g. Objective 7 Demonstrate the reliability of the SAFECOMP system.

2.4 SCOPE AND LIMITING FACTORS.

2.4.1 Scope. The SAFECOMP system was manufactured to meet the requirements of the Oak Ridge National Laboratories purchase request. Fifty of these units were delivered for a concurrent Developmental Test and Evaluation/Initial Operational Test And Evaluation (DT&E/IOT&E) test series. AFESC/RDCF, with AFOTEC, Det 2 as advisors, tested these units in an operational environment to determine their operational effectiveness and suitability. Pending satisfactory incorporation of the recommended improvement areas resulting from this test series, these units will be purchased and deployed for world-wide Air Force use. Fifty of these units were operationally fire tested at Tyndall AFB, Fl. using surplus computer equipment and laboratory facilities in environments as near to actual conditions as possible. After successful completion of these tests, these units were deployed to seven Air Forces facilities for reliability testing. The host base monitored the SAFECOMP systems for six months while they were installed in operational computer systems. These same units were returned to Tyndall AFB, Florida and the operational fire tests repeated.

2.4.2 Limiting Factors. The SAFECOMP units available for this test series were first article units that will be very similar to the actual production units. However, it is the intent of this test to incorporate significant results in final production units. These significant modifications, if any, will require retesting in a Follow-on Operational Test and Evaluation (FOT&E). Reliability was only demonstrated during the DT&E/IOT&E since a MTBCF requirement of 10 years could not be assessed during the 6-month evaluation.

2.5 SECURITY

All aspects of this program are unclassified.

2.5.1 Operations Security. A review was conducted and it was determined that this program is not susceptible to hostile exploitation. However, routine

OPSEC precautions were taken and any test program elements that are subsequently identified as susceptible to exploitation will brought to the attention of the Test Director who will, in turn, inform the AFESC OPSEC monitor.

2.5.2 Tempest Assessment. Section 6-7 of NACSIM 5203 (see reference) concerning utility control lines, fire protection, fire alarms, etc., generally deals with control lines which at some point must exit the controlled space. This system does not exit the controlled space, therefore section 6-7 does not pertain to this installation.

Due to the nature of this installation it was determined that NACSIM 5203 section 3-6, paragraph (c) is applicable. Because this fire protection system is totally contained within the controlled or limited access area, filtering and/or isolation was not required. The only exit to the uncontrolled access area is through existing fire protection and alarm circuits, which were TEMPEST approved at the time of their installation. The contact closure to the existing circuits were made through conduit and terminated in a non-conductive fixture. The interface from the computer cabinet mounted alarm modules to the wall mounted alarm modules is via a 3.2 KHz audio tone which would only be activated in an alarm condition, at which time the computer would be shut down, so data modulation of the tone would not occur.

Assuming all power connections to this system are made through RED feeds, no TEMPEST violations are evident.

References: "Guidelines For Facility Design and Red/Black Installation", NACSIM 5203.

SECTION III

OPERATIONAL EFFECTIVENESS

3.0 GENERAL

This section documents the test results and conclusions based upon the test methods and criteria listed with each objective. DT&E and IOT&E Operational Effectiveness Objectives (Objectives 1 - 5) are discussed in this section. The separate tests used to address the individual objectives are described under Section II, Test Description.

3.1 EVALUATION CRITERIA AND RATING SYSTEM

The overall DT&E/IOT&E Operational Effectiveness evaluation criterion was the unit must meet all performance requirements of the AFESC SAFECOMP Test Plan, Oct 88. The overall OT&E evaluation criterion was the SAFECOMP system must provide improved fire protection for Air Force computer and electronic equipment cabinets.

Throughout the test the following criteria were used in the evaluation of the unit:

THRESHOLD - The quantitative of qualitative level of performance that meets minimum requirements for acceptability to support mission accomplishment.

GOAL - The quantitative of qualitative level of performance that is desired and exceeds the minimum requirements or threshold.

The following rating system was used to evaluate the system performance for each individual test objective:

EXCELLENT	Performance that meets or exceeds the goal(s).
SATISFACTORY	Performance that meets or exceeds a requirement or threshold.
MARGINAL	Performance that does not consistently meet or exceed a requirement of threshold, but is not "Unsatisfactory". A marginal rating implies that performance is less than satisfactory, that it can be used, but needs improvement.
UNSATISFACTORY	Performance that is below the requirement of threshold.

3.2 OPERATIONAL EFFECTIVENESS BY OBJECTIVE

3.2.1 Objective 1. Verify that the SAFECOMP system meets the specifications and performance requirements of the AFESC prototype development specification, for physical configuration and low battery alarm.

3.2.1.1 Measures of Effectiveness and Evaluation Criteria. The SAFECOMP unit must be small enough to fit inside main-frame computer cabinets. The dimensions may not exceed 5 inches wide, 5 inches deep and 11 inches long. The weight of the capsule, including the 1 pound container of Halon, shall not exceed 5 pounds. The capsule must be completely self-contained and powered. The battery must be capable of continuous operation for two full years and provide a low-battery warning. When the battery is below 7.5 volts the unit shall produce a chirping sound at least twice per minute. The unit shall remain operable at this voltage.

3.2.1.2 Method of Test. During Phase I testing, the SAFECOMP units were measured, weighed and operated to determine system compliance with physical and electrical specifications. A tape measure and scale were used to measure physical characteristics of the SAFECOMP capsule. The low battery alarm was tested by placing a battery that was discharged to 7.5 volts in a SAFECOMP unit and monitoring the unit for proper operation and the required audio low battery signal.

3.2.1.3 Results and Conclusions. Fifty SAFECOMP capsules were weighted and measured. The average capsule weight with halon charge was 2.25 pounds and 1.25 pounds with the halon discharged. The dimensions of all capsules were 4.25" x 4.25" x 10.5" inches. Three of the standard lithium batteries were discharged to 7.5 volts and and installed in three SAFECOMP units for evaluation. The units continued to function properly until the batteries were discharged below 5.7 volts. The low battery warning alarm functioned normally below 7.5 volts. Alkaline batteries were also tested and found to be satisfactory. The basic difference between the two types is the lithium batteries can be recharged and the alkaline batteries are not. The charging feature is not suitable for computer operations that must meet Tempest Assessment requirements, but may be a desirable feature when Tempest requirements are not a consideration. Based on the weights and measures recorded and the results of the low-battery tests performed, this objective is rated satisfactory.

3.2.2 Objective 2. Assess the capability of the SAFECOMP system to detect smoke in the incipient stage of a computer compartment fire.

3.2.2.1 Measures of Effectiveness and Evaluation Criteria. The measure of effectiveness is the timeliness of SAFECOMP smoke detection. The evaluation criteria is the SAFECOMP smoke detection audible alarm must activate within 3 minutes of visible smoke, as observed by the test conductor. A maximum of 1 failure in 12 test events is permitted.

3.2.2.2 Method of Test. Fire tests were conducted at two locations during Phases I and III, the AFESC Fire Test Facility in Building 21 and the AFESC Environmental Laboratory, Building 1117, both at Tyndall AFB, Florida.

Tests conducted at Building 21 were completed by installing a single SAFECOMP system inside a surplus first generation mainframe computer cabinet. The SAFECOMP capsule was located in the center section of the computer. Two

SAFECOMP alarm receivers were placed 35′ and 50′ from the computer cabinet containing the SAFECOMP capsule. A transformer was located in the bottom of the cabinet to provide the source of smoke and/or ignition. The transformers secondary was shorted to cause an overload and allow smoldering and/or ignition of the transformer. With the computer and cabinet cooling fans operating the transformer was energized, resulting in overheating and either smoke or smoke and fire conditions occurring inside the computer cabinet containing the SAFECOMP capsule.

A properly operating SAFECOMP system detects the smoke, releases its 1 pound of halon and sounds an audible alarm. This audible alarm is received by the alarm receiver(s), relayed to the facility supervisory alarm systemwithin 2 seconds, and the fire department is alerted in a maximum of 14 to 16 seconds.

The actions of the SAFECOMP system were monitored and recorded. A total of 20 test events were accomplished.

A total of 30 tests were performed at the AFESC Environmental Laboratory, Building 1117 utilizing a laboratory ventilated hood system. The hood was modified to approximate a 45 cubic foot enclosure and tests were conducted with the ventilator on and off to evaluate both ventilation conditions. The source of smoke and fire was transformer wiring and insulation and approximately 2 ounces of alcohol contained in a beaker in the bottom of the hood. A SAFECOMP capsule was located in the center of the hood enclosure. Two SAFECOMP alarm receivers were placed at 35′ and 50′ distance from the SAFECOMP capsule for detection of the SAFECOMP audio signal. At the beginning of each test the alcohol was ignited and the hood closed to contain the fire. System performance was monitored, timed, and recorded.

3.2.2.3 Results and Conclusions. During both the laboratory and computer cabinet fire tests, the SAFECOMP capsules sounded the audible alarm, verifying smoke detection, within the 3 minute detection time requirement. Average detection time was 45 seconds for the laboratory fires and 48 seconds for the computer cabinet fires. Complete test results are contained in Tables 1 and 2, SAFECOMP Laboratory and Computer Fire Test Data. Based on the computer and laboratory fire test results, this objective is rated satisfactory.

3.2.3 Objective 3. Assess the capabilities of the SAFECOMP system to extinguish a computer compartment fire.

3.2.3.1 Measures of Effectiveness and Evaluation Criteria. The measures of effectiveness are the timeliness of the Halon discharge and the effectiveness of the fire suppression. The evaluation criteria are complete SAFECOMP Halon discharge within 10 seconds and sufficient discharge to extinguish the fire. For 12 test events no failures to extinguish the fire were permitted.

3.2.3.2 Method of Test. This objective was evaluated during Phase I and III of the test series. Test set-up and conduct is described under Objective 2, Method of Test. The actions of the SAFECOMP system were monitored and recorded.

3.2.3.3 Results and Conclusions. A total of 50 tests were conducted and recorded to measure the timeliness of the Halon 1211 agent discharge and it's effectiveness in fire suppression. In each test the Halon 1211 contents were discharged within 10 seconds and fire suppression was achieved in 1 to 3 seconds. Complete test results are contained in Tables 1 and 2, SAFECOMP Laboratory and Computer Fire Test Data. Based on the computer and laboratory test results, this objective is rated excellent.

TABLE 1. SAFECOMP LABORATORY FIRE TEST DATA

TEST NO.	DATE	UNIT NO.	SMOKE VISIBLE	LOCAL ALARM	INITIAL DETECTION TIME (SEC)	R/T ALARM	R/T ALARM TIME (SEC)	AGENT RELEASE	FIRE DEPT. NOTIFY	F.D. NOTIFY TIME (SEC)	FIRE EXT.	FIRE EXT. TIME (SEC)
1	20/9/88	3	1302:22	1305:02	160	1305:03	1	1305:17	1305:18	16	1305:21	4
2	20/9/88	4	1311:16	1311:37	21	1311.38	1	1311:51	1311:52	15	1311:56	5
3	20/9/88	6	1335:16	1337:15	119	1337:16	1	1337:29	1337:30	15	1337:40	11
4	20/9/88	2	1508:44	1509:43	59	1509:44	1	1510:00	1510:01	18	1510:12	12
5	20/9/88	3	1522:06	1523:26	80	1523:26	0	1523:40	1523:41	15	1523:45	5
6	20/9/88	15	1533:13	1534:21	68	1534:22	1	1534:36	1534:37	16	1534:41	5
7	22/9/88	5	1027:00	1027:45	45	1027:46	1	1028:00	1028:01	16	1028:04	4
8	22/9/88	4	1310:15	1312:06	111	1312:07	1	1312:21	1312:22	16	1312:30	9
9	22/9/88	16	1404:10	1405:14	64	1405:15	1	1405:27	1405:28	14	1405:34	7
10	22/9/88	15	1413:06	1415:16	130	1415:17	1	1415:32	1415:33	17	1415·36	4
11	22/9/88	3	1501:30	1502:10	40	1502:11	1	1502:24	1502:25	15	1502:29	5
12	22/9/88	1	1510:35	1510:56	21	1510:58	2	1511:10	1511:11	15	1511:15	5
13	17/10/88	9	0735:24	0736:51	87	0735:52	1	0737:06	0737:07	16	0737:11	5
14	17/10/88	10	0757:16	0757:46	30	0757:47	1	0758:01	0758:02	16	0758:05	4
15	17/10/88	11	0810:04	0810:44	40	0810:45	1	0810:59	0811:00	16	0811:03	4
16	17/10/88	19	0821:39	0822:48	69	0822:49	1	0823:02	0823:03	15	0823:06	4
17	17/10/88	15	0840:10	0840:18	8	0840:19	1	0840:32	0840:33	15	0840:36	4
18	17/10/88	18	0901:17	0901:25	8	0901:26	1	0901:39	0901:40	15	0901:41	2
19	17/10/88	12	0915:40	0915:52	12	0915:53	1	0916:06	0916:07	15	0916:11	5
20	17/10/88	17	0935:12	0935:20	8	0935:21	1	0935:35	0935:36	16	0935:39	4
21	14/08/89	34	0740:11	0740:26	15	0740:27	1	0740:41	0740:42	16	0740:44	3
22	14/08/89	35	0756:17	0756:32	15	0756:33	1	0756:47	0756:48	16	0756:50	3
23	14/08/89	39	0814:47	0815:03	16	0815:04	1	0815:18	0815:19	16	0815:21	3
24	14/08/89	40	0831:14	0831:31	17	0831:32	1	0831:46	0831:47	16	0831:51	5
25	14/08/89	36	0856:26	0856:39	13	0856:40	1	0856:54	0856:55	16	0856:59	5
26	15/08/89	41	0731:03	0731:17	14	0731:18	1	0731:32	0731:33	16	0731:38	6
27	15/08/89	44	0752:18	0752:34	16	0752:35	1	0752:48	0752:49	15	0752:51	3
28	15/08/89	43	0820:16	0820:35	19	0820:36	1	0820:49	0820:50	15	0820:55	6
29	15/08/89	42	0844:21	0844:44	23	0844:45	1	0844:59	0845:00	16	0845:02	3
30	15/08/89	46	0902:56	0903:08	12	0903:09	1	0903:22	0903:23	15	0903:25	3
		AVERAGE TIMES:			45		1			16		5

TABLE 2. SAFECOMP COMPUTER FIRE TEST DATA

TEST NO.	DATE	UNIT NO.	SMOKE VISIBLE	LOCAL ALARM	INITIAL DETECTION TIME (SEC)	R/T ALARM	R/T ALARM TIME (SEC)	AGENT RELEASE	FIRE DEPT. NOTIFY	F.D. NOTIFY TIME (SEC)	FIRE EXT.	FIRE EXT. TIME (SEC)
1	07/11/88	40	1132:55	1133:34	39	1133:34	0	1134:50	1134:50	16	1134:54	4
2	07/11/88	34	1155:20	1155:50	30	1155:50	0	1156:05	1156:05	15	1156:20	15
3	07/11/88	41	1446:10	1446:40	30	1446:40	0	1446:55	1446:55	15	1447:01	6
4	08/11/88	23	0816:02	0816:22	20	0816:23	1	0816:37	0816:38	16	0816:57	20
5	08/11/88	22	0835:05	0835:41	36	0835:42	1	0835:56	0835:57	16	0836:05	9
6	08/11/88	27	0856:15	0856:50	35	0856:51	1	0857:04	0857:05	15	0857:11	7
7	08/11/88	28	0910:02	0911:20	78	0911:21	1	0911:35	0911:36	16	0911:41	6
8	08/11/88	30	0926:06	0926:56	50	0926:57	1	0927:13	0927:13	17	0927:16	3
9	08/11/88	31	0958:26	0959:21	55	0959:22	1	0959:37	0959:38	17	0959:43	6
10	08/11/88	32	1021:43	1022:15	32	1022:16	1	1022:31	1022:32	17	1022:36	5
11	18/09/89	47	0810:56	0812:01	65	0812:02	1	0812:17	0812:18	17	0812:23	6
12	18/09/89	48	0831:11	0831:52	41	0831:54	2	0832:09	0832:10	18	0832:15	6
13	18/09/89	50	0855:21	0856:09	48	0856:10	1	0856:25	0856:26	17	0856:32	7
14	18/09/89	16	0921:12	0921:58	46	0921:59	1	0922:14	0922:15	17	0922:21	7
15	18/09/89	18	0943:16	0944:04	48	0944:05	1	0944:21	0944:22	18	0944:26	5
16	19/09/89	4	0820:07	0821:03	56	0821:04	1	0821:19	0821:20	17	0821:25	6
17	19/09/89	9	0851:36	0852:40	64	0852:41	1	0852:56	0852:57	17	0853:01	5
18	19/09/89	25	0920:06	0920:48	42	0920:49	1	0921:04	0921:05	17	0921:09	5
19	19/09/89	2	0947:31	0948:40	69	0948:41	1	0948:56	0948:57	17	0949:03	7
20	19/09/89	3	1012:05	1013:12	67	1013:13	1	1013:29	1013:30	18	1013:35	6
			AVERAGE TIMES:		48		1			17		7

3.2.4 Objective 4. Assess the compatibility of the receiver/transmitter with the SAFECOMP units and its ability to detect audio signals from one or more SAFECOMP units, and interface with the facility's supervisory alarm system.

3.2.4.1 Measures of Effectiveness and Evaluation Criteria. The measures of effectiveness are noise discrimination and the timeliness of the warning transmissions. The evaluation criteria are the receiver/transmitter must distinguish between background noise up to 85 dBm and the signal produced by the SAFECOMP units. The receiver shall receive audio signals from SAFECOMP units and display the status indicator light within 2 seconds and transmit the detection signal to the facility supervisory panel within 18 seconds, as indicated by the status indicator light. The system shall not produce false alarms at a rate greater than one per 2 years of operation. A minimum of 12 test events will be accomplished with no failures permitted.

3.2.4.2 Method of Test. Operational compatibility of all components of the system, to include the computer facility's supervisory alarm system was evaluated during Phase II testing. Fifty SAFECOMP capsules and eight Receiver/Transmitter units were installed and operated over a six month period at seven operational Air Force computer/electronic facilities within CONUS. The Receiver/Transmitter units were interfaced with the facilities supervisory alarm panel and the alarm circuit tested to verify proper notification of the base fire department control center in the event of an activation. All systems were monitored 24 hours per day for proper operation and potential false alarms.

Activation times were tested during all three Phases of the test program; During Phases I and III in conjunction with the fire tests described under Objective 2 and during the initial part of Phase II using a receiver/transmitter unit interfaced with the AFESC computer in Building 1120, Tyndall AFB, Florida. Background noise was typical for computer facilities at

approximately 65 dbm. During Phase II testing a SAFECOMP unit was manually activated to produce the audible alarm signal. The Receiver/Transmitter unit was monitored for the correct response and timing. The output of the facility supervisory fire detection system was also monitored to verify test results.

3.2.4.3 Results and Conclusions. Throughout all phases of the test and over 50 SAFECOMP unit activations, the Receiver/Transmitter alarm times averaged one second and the fire department notifications times (R/T output signal to supervisory alarm system) averaged 16 seconds. Test data are contained in Tables 1 and 2. While the system was not evaluated in a measured noise environment at 85 dbm, it was operated in seven operational Air Force computer facilities with nominal noise levels of 65 dbm without any noise interference problems. Over a million operational hours were compiled on the 50 SAFECOMP capsules and eight Receiver/Transmitter units during Phase II testing. During the six-month test period no computer down time or false alarms were experienced. Based on Phase I, II, and III test results this objective is rated satisfactory.

SECTION IV

OPERATIONAL SUITABILITY

4.0 GENERAL

This section addresses the Operational Suitability objectives of the test, along with the Measures of Effectiveness and Evaluation Criteria, the Method of Test, and the Results and Conclusions for each objective. The separate tests used to address the individual objectives are described under Section II, Test Description.

4.1 EVALUATION CRITERIA AND RATING SYSTEM

The overall IOT&E evaluation criterion was that the unit must provide the Air Force with significantly enhanced protection for Computer-Electronic equipment which present an unusually high risk of internal fire ignition.

Throughout the test the following criteria were used in the evaluation of the unit:

THRESHOLD	-	The quantitative of qualitative level of performance that meets minimum requirements for acceptability to support mission accomplishment.
GOAL	-	The quantitative of qualitative level of performance that is desired and exceed the minimum requirements or threshold.

The following rating system was used to evaluate the system performance for each individual test objective:

EXCELLENT	Performance that meets or exceeds the goal(s).
SATISFACTORY	Performance that meets or exceeds a requirement or threshold.
MARGINAL	Performance that does not consistently meet or exceed a requirement of threshold, but is not "Unsatisfactory". A marginal rating implies that performance is less than satisfactory, that it can be used, but needs improvement.
UNSATISFACTORY	Performance that is below the requirement of threshold.

4.2 OPERATIONAL SUITABILITY BY OBJECTIVE

4.2.1 Objective 5. Assess the maintainability of the SAFECOMP system when it is operated and maintained by base level civil engineering fire alarm servicing technicians or computer system operators.

4.2.1.1 Measures of Effectiveness and Evaluation Criteria. The measures of effectiveness are the mean time to repair (MTTR), false alarm rate, audible built-in test (BIT), and the subjective assessment by maintenance personnel on the SAFECOMP maintainability. The evaluation criteria are a MTTR of not more than 0.5 hours, a false alarm rate of no more than one every two years, and maintenance personnel rating SAFECOMP maintainability as satisfactory.

4.2.1.2 Method of Test. Throughout the test series operational Air Force civil engineering fire alarm servicing technicians serviced and maintained the SAFECOMP units. At the beginning of the test they were given initial training by the AFESC Test Director. Their proficiency in the servicing and maintenance of the SAFECOMP units was monitored by the Test Director to determine the relative ease of serviceability and maintainability of the unit by operational personnel. Reservicing times were monitored and recorded.

4.2.1.3 Results and Conclusions. During Phase II, 124 operational personnel received four hours of initial training and indoctrination on the repair, servicing and maintainability of the SAFECOMP system by the AFESC Test Director. These personnel reserviced and maintained SAFECOMP units during the 6-month Phase II test period. Average reservicing times were 20 minutes. While maintenance personnel did rate the SAFECOMP unit satisfactory for maintainability, a few areas could be improved. The firing trigger mechanism and wiring should be made more robust and less susceptible to damage during maintenance operations. As is, the unit is somewhat susceptible to damage during maintenance operations. This objective is rated satisfactory.

4.2.2 Objective 6. Assess the adequacy of the technical data to facilitate the servicing and maintenance of the unit by civil engineering fire alarm servicing technicians or computer system operators.

4.2.2.1 Measures of Effectiveness and Evaluation Criteria. The measure of effectiveness is the subjective assessment by maintenance personnel of the SAFECOMP technical data. The evaluation criteria is a rating, by maintenance personnel, of satisfactory on the adequacy of the technical data.

4.2.2.2 Method of Test. Throughout the test series operational Air Force civil engineering fire alarm servicing technicians serviced and maintained the unit, using the manufacturer's technical data. They were given initial training by the AFESC/RDCF Test Director at the beginning of the test. Their proficiency in the service and maintenance of the unit was monitored by the Test Director. Government evaluators determined the sufficiency of the technical data by evaluating the performance of the operational test subjects during operations and maintenance of the unit.

4.2.2.3 Results and Conclusions. Appendix A, Annex L "SAFECOMP Installation and Inspection Procedures" and Annex M "SAFECOMP Data Collections Sheets" were used by operational personnel to service and maintain the units. These data proved satisfactory for all servicing and maintenance activities during the test. During FSD, a standard Air Force Technical Order will be developed and evaluated during a Follow-on Operational Test and Evaluation (FOT&E).

4.2.3 Objective 7. Demonstrate the reliability of the SAFECOMP system.

4.2.3.1 Measures of Effectiveness and Evaluation Criteria. The measures of effectiveness are mean time between critical failure (MTBCF) and a subjective assessment by the test team of the SAFECOMP reliability. The evaluation criteria are an MTBCF of at least 10 years and the test team rating of the SAFECOMP reliability as satisfactory.

4.2.3.2 Method of Test. Throughout the test series, operating time and any failure data were recorded on test data sheets provided by the Test Director. At the completion of the test series the total operating hours and failures for each unit used in the test were compiled and evaluated for the SAFECOMP system.

4.2.3.3 Results and Conclusions. Over a million operational hours were compiled on the 50 SAFECOMP capsules and eight Receiver/Transmitter units during Phase II testing. During the six month IOT&E no false alarms were received by the fire department and no computer downtime resulted from the test. At approximately the mid-point of Phase II testing, six of the velcro mounting straps became loose causing their associated SAFECOMP capsules to fall inside of the computer cabinets. The fall of the capsule resulted in the activation of three of the units. The three capsules discharged their Halon 1211 contents (one pound of agent) inside the computer cabinets, however, no damage to the computer equipment occurred. The activation of the three units did alarm the Receiver/transmitter unit, the facility supervisory alarm system, and correctly notified the fire department, as designed. This was the only false alarm encountered throughout the test period, and since it was caused by a mechanical failure of the mounting strap and not an internal system component, it is not considered critical and is therefore not included in the false alarm count. After this mounting strap failure the AFESC Test Director directed all seven test site points of contact to inspect all hanger brackets and apply several beads of adhesive cyanoacrylate (super glue) NSN 8040-00-142-9193 to the brackets adhesive strips as a fix to prevent further bracket failure. No further mounting bracket failures were encountered.

The only internal SAFECOMP system electrical failure was some units sounded their low battery alarm even though the batteries were checked and found to be fully charged at 9.0 volts. The problem was traced to the

modified smoke detector circuit. The manufacturer has been notified and will correct the problem during FSD. The battery mounting will also be redesigned to provide quick exterior access and inspection.

Despite the failures noted above, no operational failures, critical or non-critical, occurred during the test period in which over a million operational hours were compiled. The manufacturer will correct the discrepancies noted and the first article units, which will be very similar to the units tested during this DT&E/IOT&E, will be reevaluated during a FOT&E. Additional reliability data will be collected and evaluated for MTBCF. Although the data collected during this test series indicated excellent system reliability, sufficient data to calculate an MTBCF to meet the 10-year requirement was not possible. Based on the data obtained during this test series the reliability of the SAFECOMP is rated satisfactory.

SECTION V

REPORT SUMMARY

5.0 GENERAL

The SAFECOMP units consistently detected and extinguished fires in computer test facilities and simulated computer facilities in a laboratory test set-up. During a six month field test at seven Air Force C-E facilities no critical failures were encountered. Maintainability was deemed satisfactory, though a bit tedious in a few areas. A more robust wiring harness and latch mechanism could alleviate these minor problems. For a synopsis of the test results, by objective, see Table 3, Objective Summary.

5.1 DT&E AND OPERATIONAL EFFECTIVENESS RESULTS

The SAFECOMP unit meets all the physical requirements of the purchase description, i.e., weight, dimensions, and operational temperature range. The low-battery alarm indicated a low battery on some units, even though the batteries were fully charged to 9.0 volts. During laboratory and simulated computer fire testing, the units consistently detected smoke and activated within the required 3 minutes. The halon consistently discharged all halon within the required time limit and extinguished computer cabinet fires on all occasions. The system was not tested in an 85 dbm background noise, as originally planned, but in all seven Air Force operational C-E facilities in which the systems were tested, with typical background noise levels of 65 dbm, the systems operated consistently without noise interference problems. The Receiver/Transmitter units operated reliably and alarmed with in the required 2 second limit and interfaced properly with facility supervisory alarm systems in automatically notifying the fire department.

TABLE 3. OBJECTIVE SUMMARY

OBJECTIVE		EXC	SAT	MAR	UNSAT
DT&E/IOT&E OPERATIONAL EFFECTIVENESS					
1	PHYSICAL SPECIFICATIONS		X		
2	DETECT INCIPIENT FIRES		X		
3	EXTINGUISH C-E FIRES		X		
4	NOTIFY OCCUPANTS & FIRE DEPARTMENT		X		
IOT&E - OPERATIONAL SUITABILITY					
5	MAINTAINABILITY		X		
6	TECHNICAL DATA ADEQUACY		X		
7	RELIABILITY		X		

5.2 OPERATIONAL SUITABILITY RESULTS

SAFECOMP units were maintained throughout the test program by base level C-E fire alarm technicians using the manufacturer's technical data. Maintainability and technical data adequacy were rated satisfactory. Only two minor reliability problems occurred during the 6-month test period. Six of the Velcro mounting brackets failed, allowing the SAFECOMP units to fall to the bottom of their computer cabinets, The problem was easily corrected with additional superglue and the problem did not reoccur. Some of the units sounded their low battery alarm, even with a fully charged battery. Both problems will be corrected by the manufacturer before FSD. Despite the failures noted above, no operational failures, critical or non-critical, occurred during the test period in which over a million operational hours were compiled.

5.3 CONCLUSIONS

The SAFECOMP system provides fire detection and suppression inside the computer cabinet without the release of a large quantity of fire extinguishing agent. The small amount of Halon 1211 (one pound) in SAFECOMP is safe, leaves no residue and has a very low ozone depletion potential (ODP) of 2.4 per pound as compared to total flood system with hundreds of pounds of Halon 1301 and an ODP of 12. SAFECOMP will replace Halon 1301 total flood systems at an installation and life-cycle cost savings of 90 + percent.

The SAFECOMP system has been validated and the performance specifications meet. The system has the potential to meet and exceed all of the objectives required for an automatic computer-electronic fire extinguishing system for worldwide Air Force use.

5.4 RECOMMENDATIONS

Transition this technology to Full Scale Development. Include full consideration of the areas detailed under paragraph 5.5 below during FSD.

5.5 SUMMARY OF TEST RESULTS AND RECOMMENDATIONS FOR FURTHER EVALUATION

The following is a compilation of the assessments of the SAFECOMP system by operational firefighters and C-E personnel while performing various operations during the test series. These areas should be investigated further during FSD and reevaluated during FOT&E.

5.5.1 Mounting bracket failures noted in paragraph 4.2.3.3, with corrective action to prevent additional failures during the remainder of the test, will require a more permanent fix in securing the bracket.

5.5.2 Battery location noted in paragraph 4.2.3.3 requires redesign for quick exterior access and inspection.

5.5.3 The Receiver/Transmitter unit tested during this DT&E/IOT&E was found to be adequate for the smaller C-E facilities (those requiring 10 or less

SAFECOMP units). However, For large C-E installations, requiring more than 10 SAFECOMP units, an upgraded R/T unit, with an integrated SAFECOMP unit supervisory capability, will be required. This requirement should be investigated further during FSD.

5.5.4 The Receiver/Transmitter unit should be redesigned to prevent automatic reset after an alarm. A manual reset capability should be provided.

5.5.5 The SAFECOMP capsule should have a visual low agent indicator to permit the rapid identification of discharged units.

5.5.6 The current round metal safety lock pin, used to prevent activation and agent discharge during shipping, should be replaced with an allen key of a suitable size to facilitate the replacement of the squib cartridge.

5.5.7 Develop an Air Force Technical Order (T.O.) for the complete operation and maintenance of the SAFECOMP system. Evaluate this T.O. for accuracy and completeness during FSD.

REFERENCES

1. Wilson, C. W., Trujillo, T. M., and Zallen, D., Selective Automatic Fire Extinguisher for Class A With Notification (SAFECOMP CAN), Vol I: Technical Report, and Vol II: Appendices, ESL-TR-83-07, Air Force Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall AFB, Florida, March 1983.

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3. SAFECOMP Developmental Test and Evaluation/Initial Operational Test and Evaluation, Test Plan, Air Force Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall AFB, Florida, October 1988.

4. HQ USAF/LEED Engineering Technical Letter (ETL) 89-3, Facility Fire Protection Criteria for Electronic Equipment Installations, 9 June 1989. 5.

5. McCarson, T. D., Logethetis, J. C., Computer Electronic Facility Fire Protection System Selection and Automation - Phase IB, (DRAFT), Air Force Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall AFB, Florida, October 1989.

DISTRIBUTION LIST

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ASD/AEMP
Wright-Patterson AFB, Oh 45433-5000

3415 ABG/DEF/DEM
Lowry AFB, Co 80230-5000

3202 CES/DEF/DEM
Eglin AFB, Fl 32542-5000

1010 CES/DEF/DEM
Cheyenne Mt AFB, Co 80914-5001

325 CES/DEF/DEM
Tyndall AFB, Fl 32403-5000

3800 ABW/DEFT/DEM
Gunter AFB, Al 36115-5000

HQ SSC/AQAE
Gunter AFB, Al 36115-5000

341 CES/DEF/DEM
Malstrom AFB, Mt 59402-5000

DET 2 AFOTEC/TEM
Eglin AFB, Fl 32542-5000

HQ 1 CEVG/SE
Barksdale AFB, La 71110-5000

DET 16, 1 CEVG/CC
P.O. Box 988
Powell, Wy 82135

APPENDIX A

SAFECOMP DT&E/IOT&E TEST PLAN

SAFECOMP

DEVELOPMENTAL TEST AND EVALUATION/ INITIAL OPERATIONAL TEST AND EVALUATION

OCTOBER 1988

TEST PLAN

AFESC

ENGINEERING & SERVICES LABORATORY
AIR FORCE ENGINEERING & SERVICES CENTER
TYNDALL AIR FORCE BASE, FLORIDA 32403

AIR FORCE ENGINEERING AND SERVICES CENTER
Tyndall Air Force Base, Florida 32403

SAFECOMP

DEVELOPMENTAL TEST AND EVALUATION/

INITIAL OPERATIONAL TEST AND EVALUATION

12 October 1988

TEST PLAN

This test plan has been reviewed and approved by:

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ANNEX

SECTION I

TEST BACKGROUND AND PURPOSE

A. PURPOSE

The purpose of this test is to determine the operational effectiveness and suitability of the SAFECOMP (Selective Automatic Fire Extinguisher for Computers) fire detection, suppression, and notification system in a realistic operational environment.

B. BACKGROUND AND AUTHORITY

1. Background

The Air Force currently uses total flood Halon 1301 and water sprinkler fire suppression systems to protect main-frame computers and other critical high value electronic equipment. These systems are expensive to install and maintain, and cause total disruption of the computer activities when activated. The requirements to reduce cost and increase system reliability led to the development of the SAFECOMP system. AFESC completed the design concept and provided full scale development of a prototype stand-alone modular device that detects and suppresses fires as close to the fire origin as possible. These units are velcro mounted and require no modification to critical electronic equipment. The SAFECOMP system is designed to provide fire detection and suppression inside the computer cabinet where the greatest potential for fire exists and without the release of a large quantity of fire extinguishing agent. The small amount of Halon 1211 (one pound) in SAFECOMP is safe, leaves no residue and has a very low ozone depletion factor of 2.4 per pound as compared in total flood Halon 1301 with hundreds of pounds and an ozone depletion factor of 12. SAFECOMP will replace Halon 1301 total flood systems at an installation cost savings of 90 + percent.

Initial evaluation of the prototype models was conducted at Tyndall AFB, Florida in October 87. The AFESC computer area and the Drone control computer facility at Tyndall AFB were protected with SAFECOMP as part of this evaluation. Reference Oak Ridge National Laboratory (ORNL) Technical Report "SAFECOMP" Test and Evaluation Project.

2. Authority

HQ USAF Program Management Directive (PMD) Number 2132, Civil and Environmental Engineering Technology, Program Element Number 622104/System Project Number 63723F, provides the authority for this test. HQ MAC/SAC/TAC/ DRAFT SON, HQ AFESC/DEF Letter and Department of Defense (DoD) and Environmental Protection Agency (EPA) provide additional direction for the program. This test program will be conducted as directed by AFR 80-14 and AFR 55-43.

C. PROGRAM SCHEDULE AND MILESTONES

This test program will be conducted in three phases as follows:

Phase I: A 2-week period at Tyndall AFB, FLorida.

Phase II: A 6-month period at selected CONUS Air Force facilities.

Phase III: A 2-week period at Tyndall AFB, Florida.

The test start is planned for 24 October 1988 with a projected test completion date of 30 September 1989..

D. SAFECOMP SYSTEM DESCRIPTION

The SAFECOMP system provides fire detection, suppression, and notification in a self-contained, battery operated capsule consisting of four major components and a receiver/transmitter. The SAFECOMP capsule consists of a lithium battery operated ionization smoke detector, a 16 oz. Halon 1211 replaceable cylinder, a squib activated (pyro-pneumatic) cartridge, and an 85 dbm audible warning device. This system is designed for installation with a velcro-mounted bracket inside electronic computer cabinets. No holes, wires, or modifications are required. One or more capsules may be installed in each cabinet to provide the 4 to 6 percent concentration of Halon required for fire extinguishment. Cabinets greater than 42.7 cubic feet would require more than one unit. A wall mounted discriminating receiver/transmitter unit will be wired into the supervisory fire alarm system. The receiver is capable of receiving signals from one or more capsules and transmits a signal to the supervisory fire alarm panel which can be programmed to notify the fire department and phase down computer operations or other systems, as required. A photograph of the SAFECOMP system is included in Figure 1.

E. SYSTEM OPERATIONAL AND MAINTENANCE CONCEPT

Pending positive test results from this DT&E/IOT&E, SAFECOMP systems will be an option to the use of total flood Halon 1301 fire suppression systems for protection of computer/electronic equipment from internal fires. SAFECOMP will become the standard fire protection for computer/electronic equipment.

Essentially, SAFECOMP is a stand-alone fire alarm and suppression system for computer facilities. Base level civil engineering fire alarm servicing technicians will operate ano @maintain each SAFECOMP unit for this DT&E/IOT&E. Systems will be maintained by the civil engineering craftsmen, computer systems operators, or contract. Systems will require monthly visual inspections, a semi-annual weight check of the cylinder and an annual alarm and transmitter test. The level of maintenance is similar to that of other fire detection systems.

Complete operations and maintenance procedures are contained in the manufacturer's Operations Manual for SAFECOMP. A standard Air Force Technical Order is scheduled for development.

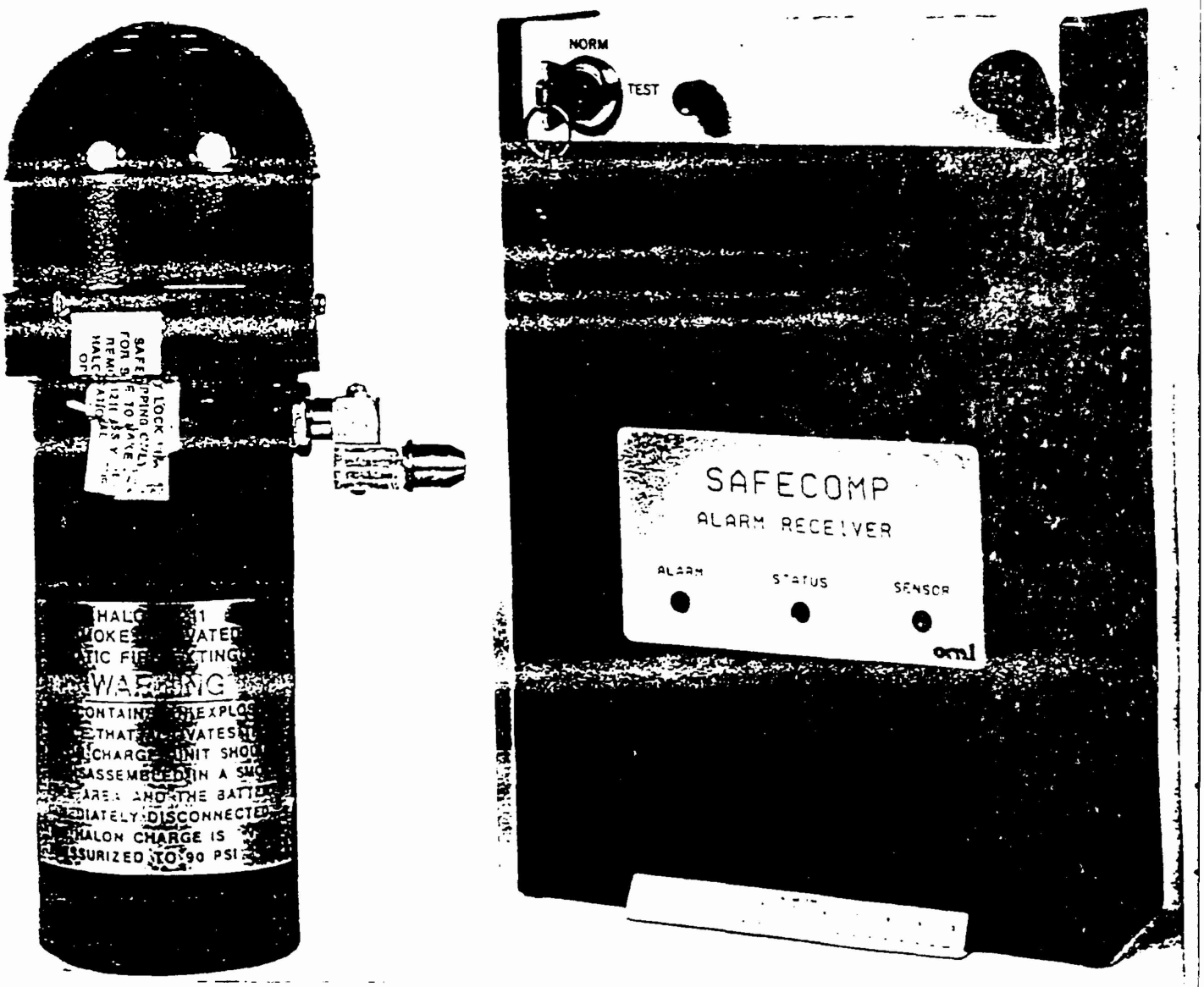


Figure 1. SAFECOMP System

F. SCOPE AND LIMITING FACTORS

1. Scope

The SAFECOMP system has been manufactured to meet the requirements of the Oak Ridge National Laboratories purchase request. Fifty of these units have been delivered for a concurrent Developmental Test and Evaluation/Initial Operational Test And Evaluation (DT&E/IOT&E) test series in the fall of 1988. AFESC/RDCF, with AFOTEC, Det 2 as advisors, will test these units in an operational environment to determine their operational effectiveness and suitability. Pending satisfactory test results, these units will be purchased and deployed for world-wide Air Force use. Twelve of these units will be operationally fire tested at Tyndall AFB, Fl. using surplus computer equipment in environments as near to actual conditions as possible. Upon successful completion of these tests, these units will be deployed to seven Air Forces facilities for reliability testing. The host base will monitor the SAFECOMP systems for six months while they are installed in operational computer systems. These same units will again be returned to Tyndall AFB, Florida and the operational fire tests will be repeated.

2. Limiting Factors

The SAFECOMP units available for this test series are first article units that will be very similar to the actual production units. However, it is the intent of this test to incorporate significant results in final production units. These significant modifications, if any, will require retesting in a Follow-on Operational Test and Evaluation (FOT&E). Reliability will only be demonstrated during the DT&E/IOT&E since a MTBCF requirement of 10 years can not be assessed during the 6-month evaluation.

G. TEST LOCATIONS

This test will be conducted in three phases at the locations indicated:

Phase I: Tyndall AFB, Florida, using the fire training smoke house (Building 21) and AFESC Environmental Laboratory (Building 1117).

Phase II: Selected Air Force Facilities.

Tyndall AFB - TAC/Weapons Evaluation Bldg 1801.
Tyndall AFB - AFESC/WANG CPU Bldg 1120-C
Gunter AFS - AFCC/Standard System Center Bldg 859.
Air Force Academy / Computer Center.
Lowry AFB - ATC/AF Finance/Accounting Center Bldg 444.
Powell WY - SAC/Radar Unit 1st CEVG.
Eglin AFB - AFSC/WANG CPU, Bldg 696.
Cheyenne Mountain AFB, Co - AFSPACECOM

Phase III: Tyndall AFB, Florida repeat Phase I test.

H. TEST MANAGEMENT

The Responsible Test Organization is the Air Force Engineering and Services Center (AFESC/RDCF). The AFESC/RDCF Test Director has total responsibility for the test. Test data collection is the responsibility of the local Computer Operations Manager (Test Site Supervisor) at the seven test locations. The AFESC SETA contractor is responsible for planning conduct and test reporting under the direction of the AFESC/RDCF Test Director.

I. TRAINING REQUIREMENTS

Test participants will be Air Force Civil Engineering Fire Alarm Technicians and Computer Systems operators who are familiar with the operation of SAFECOMP system. The minimum training these personnel will require to become familiar with the new SAFECOMP system will be given at the beginning of the test series by the AFESC/RDCF Test Director.

J. ENVIRONMENTAL IMPACT

This headquarters has determined that the conduct of this test series will have no adverse effects on the environment.

K. SAFETY

Overall safety responsibility lies with the Test Director. The Test Director or personnel participating in the test will suspend the test any time a safety hazard is observed. The test will remain suspended until the hazard can be evaluated and corrected to the satisfaction of all responsible agencies. During the operational test, a deliberate short circuit will be caused to generate smoke and heat to activate the SAFECOMP system. Personnel will not be in the immediate area of the short circuit. Safety responsibility is further discussed in Annex K.

L. SECURITY

All aspects of this program are unclassified.

M. OPERATIONS SECURITY

1. A review has been conducted and it has been determined that this program is not susceptible to hostile exploitation. However, routine OPSEC precautions must be taken and any test program elements that are subsequently identified as susceptible to exploitation must be brought to the attention of the Test Director who will, in turn, inform the AFESC OPSEC monitor.

2. Tempest Assessment

Section 6-7 of NACSIM 5203 (see reference) concerning utility control lines, fire protection, fire alarms, etc., generally deals with control lines which at some point must exit the controlled space. This system does not exit the controlled space, therefore section 6-7 does not pertain to this installation.

Due to the nature of this installation it has been determined that NACSIM 5203 section 3-6, paragraph (c) is applicable. Because this fire protection system will be totally contained within the controlled or limited access area, filtering and/or isolation will not be required. The only exit to the uncontrolled access area will be through the existing fire protection and alarm circuits, which have been TEMPEST approved at the time of their installation. The contact closure to the existing circuits will be made through conduit and terminated in a non-conductive fixture. The interface from the computer cabinet mounted alarm modules to the wall mounted alarm modules is via a 3.2 KHz audio tone which would only be activated in an alarm condition, at which time the computer would be shut down, so data modulation of the tone would not occur.

Assuming all power connections to this system are made through RED feeds, no TEMPEST violations are evident.

References: "Guidelines For Facility Design and Red/Black Installation", NACSIM 5203.

N. RELEASE OF INFORMATION

Any release of test information will be coordinated through the Test Director, AFESC/RDCF, and AFESC/PA.

SECTION II

METHOD OF ACCOMPLISHMENT

A. INTRODUCTION

This test plan will provide the guidelines for operational fire testing of first article SAFECOMP units. In addition, SAFECOMP systems will be deployed to seven Air Force units for operational field testing for a period of six months. This test will evaluate the reliability and maintainability of the SAFECOMP system in an operational environment. Environmental fire testing scenarios will include air movement of 200 cfm and background noise of approximately 85 dbm.

B. CRITICAL ISSUES

The following Critical questions concerning the SAFECOMP system were formulated by discussions with operational Air Force fire alarm technicians and computer systems operators/managers. These Critical questions were used in formulating the test objectives, test approach, and test methods.

1. Does the SAFECOMP system meet the specifications and performance requirements of the AFESC prototype development specification, for physical configuration and low battery alarm?

2. Will the SAFECOMP unit detect smoke in the incipient stage of a fire?

3. Will the SAFECOMP unit extinguish a computer fire?

4. Will the SAFECOMP system receiver/transmitter unit detect the audio signal from one or more SAFECOMP units and properly interface with the facility's supervisory fire detection system?

5. Can the SAFECOMP system be serviced and maintained when it is operated and maintained by base level civil engineering fire alarm servicing technicians or computer system operators?

6. Is the technical data provided by the SAFECOMP system manufacturer adequate to permit the unit to be maintained by civil engineering fire alarm servicing technicians or computer system operators?

7. Does the mean time between critical failure (MTBCF) of the SAFECOMP system meet the 10-year minimum requirement?

C. APPROACH

The test will be conducted in three phases to verify all aspects of the SAFECOMP system.

1. Phase I: Operational fire testing will be conducted at Tyndall AFB, Florida, using the fire test facility at building 21. The SAFECOMP system will be tested under operational conditions by shorting a transformer to cause smoke and/or fire. Laboratory testing will also be conducted at the AFESC Environmental Laboratory (building 1117) at Tyndall AFB. The laboratory testing will consist of igniting electrical wiring and insulation using alcohol as the fuel under a ventilation hood. This series of tests will evaluate the SAFECOMP system capability in fire detection, suppression, and it's interface with the receiver/transmitter unit. An electrical fire may smolder for some time before producing any flame and generate small amounts of heat. The smoke concentration level will vary greatly as a function of the fuel load (electrical wiring) and the heat being generated (power supply). Consequently, the system activation time will vary greatly. The system must detect and extinguish the fire at its source before any significant damage results.

For the purpose of these tests the total fire area is considered to be computer cabinets of 20 to 45 cubic feet. Two classes of fire are of principal concern. Class "A" being the insulation around the wiring and Class"C" is the wiring itself. A 4 to 6 percent concentration of Halon is required to extinguish fires of this nature.

The notification process is further divided into two separate sections. The local alarm produced by the SAFECOMP capsule is an 85 dbm signal at a preset frequency. The receiver/transmitter is normally wall mounted and interfaces with the facility supervisory fire detection system. Upon activation the receiver/transmitter will discriminate between any background noise and the signal and close an electrical contact to interface with the supervisory fire alarm system.

2. Phase II: Upon successful completion of the operational test, these SAFECOMP systems will be deployed to seven Air Force units. The Test Director will accompany the units to each location, brief base level personnel on the SAFECOMP system, and provide the small amount of training required. Base level personnel will install the units in actual operating computers. All required maintenance and inspections will also be performed at base level. Base-level personnel will monitor the SAFECOMP systems over the 6-month field test period. A system check and inspection of the installed units will be accomplished 3 months after initial installation and at the completion of the test period. Any malfunction, activation, or other discrepancy will be included in a final report to AFESC/RDCF. At the completion of the 6-month Phase II test period, all units will be returned to AFESC/RDCF, Tyndall AFB, FLorida.

3. Phase III: Six randomly selected units from the field deployed SAFECOMP systems will be retested in the simulated computer fires as described under Phase I testing.

D. TEST OBJECTIVES

The overall objective of this test series is to verify the operational effectiveness and suitability of the SAFECOMP system for Air Force use in computer facilities. Objective 1 is a DT&E objective. Test objectives 2, 3 and 4 are DT&E/IOT&E objectives. Test Test Objectives 5, 6, and 7 are IOT&E objectives.

Specific objectives are as follows:

1. Objective 1. Verify that the SAFECOMP system meets the specifications and performance requirements of the AFESC prototype development specification, for physical configuration and low battery alarm.

2. Objective 2. Assess the capability the SAFECOMP system to detect smoke in the incipient stage of a computer compartmented fire.

3. Objective 3. Assess the capabilities of the SAFECOMP system to extinguish a computer compartmented fire.

4. Objective 4. Assess the compatibility of the receiver/transmitter to detect audio signal from one or more SAFECOMP units, and to interface with the facility's supervisory fire detection system.

5. Objective 5. Assess the maintainability of the SAFECOMP system when it is operated and maintained by base level civil engineering fire alarm servicing technicians or computer system operators.

6. Objective 6. Assess the adequacy of the technical data to permit the unit to be maintained by civil engineering fire alarm servicing technicians or computer system operators.

7. Objective 7. Demonstrate the reliability of the SAFECOMP system.

E. *EVALUATION CRITERIA*

1. The physical dimensions of the unit must not exceed 5 inches by 5 inches by 11 inches tall and weigh not more than 5 pounds when fully charged.

2. The unit sound the audible alarm within 3 minutes of the time that visible smoke is detected by the test conductor.

3. After detection and activation of the Halon discharge circuit the agent will discharge completely within 10 seconds.

4. The discharged agent must provide a Halon concentration within the cabinet sufficient to extinguish the fire.

5. The receiver/transmitter must receive the initial alarm within 2 seconds (status indicator light green to red) and transmit a signal to the supervisory panel within in 18 seconds. (Alarm indicator light red)

6. The receiver/transmitter must discriminate between background noise up to 85 dbm and the alarm.

7. The system shall not produce false alarms at a rate greater than one per 2 years of operation.

8. The system will operate continuously for the 6-month test period without requiring a battery change. The battery should be replaced every 2 years.

9. When a low-battery conditions exists the smoke detector alarm produces a chirping sound at least twice per minute. When this occurs the long-life lithium battery should be replaced with a like item.

F. DATA MANAGEMENT

1. Hand Data Recording. All data will be recorded on data forms provided by the Test Director. All forms will contain the name of the test, test subject, data recorded, and date of the test in addition to all pertinent test data for the particular test phase. Data forms will be collected daily and reviewed for their accuracy and completeness by the test data manager. Data will be entered into a microcomputer on a regular basis so as to provide rapid, efficient data analysis in a timely manner.

2. Video Data Recording. Representative excerpts of each test will be recorded on video tape.

G. RESPONSIBILITIES, SUPPORT, AND RESOURCES

1. Responsible Test Organization

Overall test responsibility rests with the AFESC/RDCF Test Director. The Test Director will delegate authority, as necessary. Specific responsibilities are as follows:

2. Organizational Responsibilities and Test Support

a. HQ AFESC

The Air Force Engineering and Services Center is responsible for overall test management.

b. AFESC/RDCF

RDCF will:

(1) Develop, coordinate, and publish a test plan.

(2) Provide the Test Director.

(3) Prepare a test report, detailing the test preparation and method of test.

c. AFOTEC, Det 2

AFOTEC, Det 2 will:

(1) Participate in the test planning activities.

(2) Review and approve the test plan.

(3) Monitor the operational test activities.

(4) Review and comment on the final report.

d. AFESC/PA (Public Affairs Office)

PA will:

Be responsible for notification and media inquiry response of the test, when applicable.

e. Tyndall AFB - TAC/Weapons Evaluation Bldg 1801.
Tyndall AFB - AFESC/WANG CPU Bldg 1120-C
Gunter AFS - AFCC/Standard System Center Bldg 859.
Air Force Academy / Computer Center.
Lowry AFB - ATC/AF Finance/Accounting Center Bldg 444.
Powell WY - SAC/Radar Unit 1st CEVG.
Eglin AFB - AFSC/WANG CPU, Bldg 696.
Cheyenne Mountain AFB, Co. - AFSPACECOM

During the 6-month field test period personnel at each location will provide support as indicated.

(1) Initial Installation

The computer facility manager, the fire chief, and the Base DEM will be notified a minimum of 10 days before the test start date concerning all base support requirements by the AFESC Test Director. Subsequent to this notification these individuals will:

(a) Coordinate the installation date with fire alarm technicians, fire inspectors, and the facility manager.

(b) Provide interconnection of the SAFECOMP receiver/transmitter to the building supervisory fire alarm system, to include 115 volt electrical wiring. Interface with the supervisory fire alarm system may be provided through a smoke detector circuit.

CAUTION: Interconnection should not allow activation of the Total Flood system after installation.

(c) Fire alarm technician will make interconnection in accordance with appropriate electrical codes and test system after installation.

(2) After Installation

The computer facility manager and fire alarm technician will:

(a) Inspect the SAFECOMP system every 3 months to determine its status as follows:

1. Insure the SAFECOMP unit and receiver/transmitter are in place.

2. Place the receiver/transmitter in " TEST" mode.

3. Move safety switch on the SAFECOMP unit to the "OFF" position and depress the detector test button. After a few seconds the unit will sound the alarm but will not discharge the Halon.

4. Record the status and alarm condition of the receiver/transmitter unit on the data sheet provided.

NOTE: **1-2 seconds for status light (Green to Red).**
14-16 seconds for alarm status light (Red).

5. Return receiver/transmitter to "NORM".

6. Check detector circuit (switch in "OFF" position on unit and receiver/transmitter in "NORM") record notification to fire alarm center and other programmed actions provided by the supervisory alarm system.

7. Return SAFECOMP unit safety switch to "ON" position. Return receiver/transmitter to "NORM".

8. Weigh the SAFECOMP units and record the weight of the individual units on the data sheets provided.

NOTE: **Record weight of SAFECOMP.**

_____ **Full Weight 1050 grams (2.15 lb).**

_____ **Empty Weight 611 grams (1.25 lb).**

(3) SAFECOMP Activations

In the event of a SAFECOMP activation the the computer facility manager and fire alarm technician will:

(a) Record reason for activation, ie. fire, smoke, and source.

(b) Recharge SAFECOMP IAW manufacturer's recharge and operational data sheet.

NOTE: A recharge unit will be provided to the fire alarm technician.

(c) Record failures and report to the AFESC/RDCF Test Director, CWO-4 Bobby Barrow, Autovon 523-6194.

3. Resources

Equipment and supplies required for support of this test are shown in Annex 2. These supplies should be assembled at the test site during the week preceding testing. Video and still photography of selected tests will be provided by AFESC/RDCF.

SECTION III

REPORTS AND BRIEFINGS

A. End-of-Task Briefing. An End-of-Task briefing will be presented by AFESC/RDCF and the SETA contractor 60 days after the test completion date.

B. Test Report (Draft). A draft Test Report will be available 60 days after the test completion date.

C. Test Report (Final). The Final (Camera Ready) Test Report will be available 30 days after all comments are received from the draft report.

D. HQ AFESC/DEF, MAJCOM fire representatives, and test site personnel will be notified by message 10 days prior to SAFECOMP installation dates by the AFESC/RDCF Test Director.

MAJCOM	AUTOVON
Mr Knowles HQ AFESC/DEF	523-6150
Mr Farrell HQ ATC/DEMF	487-2504
Mr Hunter HQ SAC/DEMF	271-4549
Mr Angus HQ 1 CEVG/SE	781-4321
Capt Hudson HQ AFCC/DEMM	576-6127
Mr Teleford HQ AFSC/DEMF	858-2915
Mr Sanchez HQ AFSPACECOM/DEMF	692-5112
CMS Evans HQ AU/DEF	875-5484

TEST SITE POINTS OF CONTACT	AUTOVON
Chief Benneyhoff Lowry AFB, Co	926-2408
Capt Vance HQ SSC/AQAE GUNTER AFS, AL	446-4940
Chief Cooper Eglin AFB, Fl	872-5856
Chief Stokes Tyndall AFB, Fl	523-2909
Lt Col Kennedy HQ AFESC/SI	523-4657
MSG Cavanauga Cheyenne Mountain AFB	834-1211 Ext 3030
Chief Hartshorn Air Force Academy	259-2051
Lt Col Pauly, Powell, Wy	632-3437

TEST SITE DEMs	
Maj Morris, Lowry AFB, Co	926-4522
Col Donvan, Gunter/Maxwell AFB, AL	875-6944
Maj Haggstrom, Eglin AFB, Fl	872-3726
Maj Meister, Tyndall AFB, Fl	523-4241
Capt Carrol, Cheyenne Mountain AFB	834-1211 Ext 3772
Maj Kukuk, Air Force Academy	259-2430

ANNEX A

OPERATIONAL EFFECTIVENESS

A. GENERAL

This annex outlines the general approach for conducting the test for each operational effectiveness objective and subobjective. The descriptions are necessarily broad to allow flexibility for response to new information as testing progresses.

B. OVERALL TEST OBJECTIVE

The overall test objective of this test is to determine the operational effectiveness and suitability of the SAFECOMP system for worldwide Air Force use in computer cabinets and other sensitive electronic equipment.

C. DATA MANAGEMENT

Data management procedures described under these paragraphs apply to each individual objective.

1. Data Collection and Processing.

All data will be either hand-recorded on data forms provided by the Test Director or recorded on video tape for later analysis. Data forms will be collected daily during test phases I and III and at the conclusion of test Phase II, by the Test Director, logged, and filed for later analysis.

2. Data Analysis.

All data collected will be entered into a microcomputer for statistical analysis and reduction to a form suitable for analysis and discussion and inclusion in the final technical report.

D. OBJECTIVES AND SUBOBJECTIVES

Each objective and subobjective stated herein outlines the Method of Test, Data Requirements, and Measures of Effectiveness specifying the minimum level of performance for the SAFECOMP system.

1. Objective 1. Verify that the SAFECOMP system meets the specifications and performance requirements of the AFESC prototype development specification, for physical configuration and low battery alarm.

a. Measures of Effectiveness and Evaluation Criteria.

The SAFECOMP unit must be small enough to fit inside most mainframe computer cabinets. The dimensions may not exceed 5 inches wide, 5 inches deep and 11 inches long. The weight of the capsule, including the 1 pound container of Halon, shall not exceed 5 pounds. The capsule must be completely self-contained and powered. The battery must be capable of continuous operation for two full years and provide a low-battery warning.

b. Method of Test.

This test objective will be tested during Phase I of the test series. A tape measure and scale will be used to measure physical characteristics of the SAFECOMP capsule. The low battery alarm will be tested by placing a battery that has been discharged to 7.5 volts in a SAFECOMP unit and monitoring the unit for the required audio low battery signal.

c. Data Requirements.

The height, diameter and weight will be hand-recorded for three SAFECOMP units. Since all units appear to be the same size and weight, additional units will be measured only if a significant difference exists between the initial 3 units. The results of the low battery test will be recorded on the data sheet provided by the Test Director.

2. Objective 2. Assess the capability the SAFECOMP system to detect smoke in the incipient stage of a computer compartmented fire.

a. Measures of Effectiveness and Evaluation Criteria.

The measures of effectiveness is the timeliness of SAFECOMP smoke detection. The evaluation criteria is the SAFECOMP smoke detection audible alarm must activate within 3 minutes of smoke visibility. A maximum of 1 failure in the 12 test events will be allowed.

b. Method of Test.

This objective will be evaluated during Phase I and III of the test series. A single SAFECOMP system will be installed inside a surplus computer cabinet. An additional electrical transformer will be installed. The cabinet's cooling fans will be operating and supplying approximately 200 cfm of air flow during each test. A deliberate electrical short circuit will be caused to create smoke and possibly fire. The actions of the SAFECOMP system will be monitored and recorded. A total of 12 test events will be accomplished.

c. Data Requirements.

Personnel conducting the test will video tape the entire test. Times for the initial transformer shorting, first visible smoke, SAFECOMP unit detection, Halon release, receiver activation, and fire extinguished will be recorded on the form provided by the Test Director.

3. Objective 3. Assess the capabilities of the SAFECOMP system to extinguish a computer compartmented fire.

a. Measures of Effectiveness and Evaluation Criteria.

The measures of effectiveness are the timeliness of the Halon discharge and the effectiveness of the fire suppression. The evaluation criteria are complete SAFECOMP Halon discharge within 10 seconds and sufficient discharge to extinguish the fire. A total of 12 test events will be accomplished with no failures to extinguish the fire permitted.

b. Method of Test.

This objective will be evaluated during Phase I and III of the test series. A single SAFECOMP system will be installed inside a computer cabinet. An additional electrical transformer will be installed. The cabinet's cooling fans will be operating and supplying approximately 200 cfm of air flow during each test. A deliberate electrical short circuit will be caused to create smoke and possibly fire. Upon activation of the smoke detector the SAFECOMP unit begins a 14 second time delay. After this time the squib will energize and discharge the canister of Halon, extinguishing the fire. The actions of the SAFECOMP system will be monitored and recorded.

c. Data Requirements.

Personnel conducting the test will video tape the entire test. Times for the initial transformer shorting, first visible smoke, detection, Halon release (start and end times), receiver activation, and fire extinguished will be recorded on the form provided by the Test Director.

4. Objective 4. Assess the compatibility of the receiver/transmitter to detect audio signal from one or more SAFECOMP units, and to interface with the facility's supervisory fire detection system.

a. Measures of Effectiveness and Evaluation Criteria

The measures of effectiveness are noise discrimination and the timeliness of the warning transmissions. The evaluation criteria are that the receiver/transmitter must distinguish between background noise and the 85 dBm signal produced by the SAFECOMP units, the receiver receives audio signals from the SAFECOMP unit within 2 seconds (status indicator light) and the transmitter transmits the detection to the facility supervisory panel within 18 seconds (status indicator light). A total of 12 test events will be accomplished with no failures permitted.

b. Method of Test.

This test will be conducted during the initial portion of test Phase II, using the receiver/transmitter interface with the AFESC computer in Building 1120, Tyndall AFB, FLorida. Background noise will be typical of computer facilities at 65 dbm. A SAFECOMP unit will be manually activated to produce the audible alarm signal. After the receiver unit receives the audio signal from the SAFECOMP unit an internal 14 to 16 second time delay is initiated, followed by an electrical contact activating, to signal the facility supervisory fire detection system that a fire has been detected. The output of the facility supervisory fire detection system will be monitored to verify test results.

c. Data Requirements.

Times for the manual activation of the SAFECOMP unit, receiver alarm, and fire department notification will be recorded on the form provided by the Test Director.

ANNEX B

OPERATIONAL SUITABILITY

A. GENERAL

This annex addresses the Operational Suitability objectives of the test, along with the Measures of Effectiveness, the Method of Test, and Data Requirements for each objective.

B. DATA MANAGEMENT

Data management procedures are the same as described in Annex A, Operational Effectiveness, and apply to each individual objective.

C. OBJECTIVES

1. Objective 5. Assess the maintainability of the SAFECOMP system when it is operated and maintained by base level civil engineering fire alarm servicing technicians or computer system operators.

a. Measures of Effectiveness and Evaluation Criteria.

The measures of effectiveness are the mean time to repair (MTRR), false alarm rate, audible built-in test (BIT), and the subjective assessment by maintenance personnel on the SAFECOMP maintainability. The evaluation criteria are a MTRR of not more than 0.5 hours, a false alarm rate of no more than one every two years, and maintenance personnel rating SAFECOMP maintainability as satisfactory.

b. Method of Test.

Throughout the test series operational Air Force civil engineering fire alarm servicing technicians will service and maintain the unit. At the beginning of the test they will be given initial training, not to exceed 1 hour, by the AFESC/RDCF Test Director. Their proficiency in the service and maintenance of the unit will be monitored by the Test Director, who will determine the relative ease of serviceability and maintainability of the unit by these operational personnel. He will time reservicing activities and observe the general reservicing performance of the operational test subjects.

c. Data Requirements.

Data sheets will be completed by Air Force evaluators recording the reservicing time and the general reservicing performance of the civil engineering fire alarm servicing technicians.

2. Objective 6. Assess the adequacy of the technical data to permit the unit to be maintained by civil engineering fire alarm servicing technicians or computer system operators.

a. Measures of Effectiveness and Evaluation Criteria.

The measures of effectiveness is the subjective assessment by maintenance personnel of the SAFECOMP technical data. The evaluation criteria is the maintenance personnel rate the technical data as satisfactory.

b. Method of Test.

Throughout the test series operational Air Force civil engineering fire alarm servicing technicians will service and maintain the unit, using the manufacturer's technical data. They will be given initial training by the AFESC/RDCF Test Director at the beginning of the test. Their proficiency in the service and maintenance of the unit will be monitored by the Test Director. Government evaluators will determine the sufficiency of the technical data by evaluating the performance of the operational test subjects during operations and maintenance of the unit.

c. Data Requirements.

Data sheets will be completed by Air Force evaluators recording the reservicing performance of the civil engineering fire alarm servicing technician test subjects, with emphasis on sufficiency of the technical data.

3. Objective 7. Demonstrate the reliability of the SAFECOMP system.

a. Measures of Effectiveness and Evaluation Criteria.

The measures of effectiveness are mean time between critical failure (MTBCF) and a subjective assessment by the test team of the SAFECOMP reliability. The evaluation criteria are an MTBCF of at least 10 years and the test team rating of the SAFECOMP reliability as satisfactory.

b. Method of Test.

Throughout the test series, operating time and any failure data will be recorded on test data sheets provided by the Test Director. At the completion of the test series the total operating hours and failures, if any, for each unit used in the test will be compiled and evaluated to calculate the MTBCF of the SAFECOMP system.

c. Data Requirements.

Data sheets will be completed by Air Force evaluators recording the operating time and failures, if any, of units used in the test. Data sheets will be provided by the AFESC/RDCF Test Director.

ANNEX C THRU I

(not applicable to this test plan)

ANNEX J

LOGISTICS SUPPORT

A. FACILITY REQUIREMENTS

The test facilities for this test include seven Air Force base computer centers and the AFESC Fire Test Facilities at Tyndall AFB, Florida.

B. PERSONNEL REQUIREMENTS

Personnel to support this test will come from numerous agencies and organizations. The following is a listing of the associated agencies and organizations and the personnel requirements of each:

Agency/Organization	Personnel Required
AFESC/RDCF	Test Director (1 ea) Data Collector (1 ea) Video Operator (1 ea)

In addition, test monitoring and data recording personnel will be required at each of the test locations indicated below during Phase II of the test.

Tyndall AFB - TAC/Weapons Evaluation Bldg 1801.
Tyndall AFB - AFESC/WANG CPU Bldg 1120-B
Gunter AFS - AFCC/Standard System Center Bldg 859.
Air Force Academy / Computer Center.
Lowry AFB - ATC/AF Finance/Accounting Center Bldg 444.
Powell WY - SAC/Radar Unit 1st CEVG.
Eglin AFB - AFSC/WANG CPU, Bldg 696.
Cheyenne Mountain AFB - AFSPACECOM

C. MATERIAL REQUIREMENTS

Material requirements are as follows for Tyndall AFB test facilities:

ITEM	QUANTITY		SOURCE
	BLDG 1117	BLDG 21	
Computer cabinets	0	6	AFESC/RDCF
Video tape	0	24 cassettes	AFESC/RDCF
35mm film	2	24 rolls	AFESC/RDCF
Transformers	2	6	AFESC/RDCF
Portable fire extinguishers	1	3	AFESC/RDCF
Ventilation system	1	1	AFESC/RDCF
Alcohol	1 gal	0	AFESC/RDCF
Electrical wiring/insulation	10 feet	0	AFESC/RDCF

D. EQUIPMENT REQUIREMENTS

ITEM	QUANTITY	
SAFECOMP systems	12 units	AFESC/RDCF
First Aid Kit	1	
35mm Still Frame Cameras	2	
VHS 1/2" Video Cameras	2	
Stopwatches	3	
AC/DC Meter	1	
Small-hand tools		
Screwdriver (Phillips-Straight)	1	
Wire Dikes	1	
Pliers	1	
Allen wrench set	1	

ANNEX K

SAFETY

A. PURPOSE

While this test imposes a minimum of hazards for personnel and equipment, all pertinent safety procedures will be followed and the test suspended if any safety hazard presents itself. This Safety Plan establishes the safety procedures for the SAFECOMP test. This plan identifies the agency responsible for the test area. This document contains detailed Safety Rules which govern the conduct of the Test Series. The Test Director will be the Safety Officer and will insure adherence of all safety policies. The following documents are applicable to this test:

AFOSH 127-40 & 42, Emergency Eye Wash
AFOSH 127-11 & 50, First Aid Kits
AFOSH 127-31, Personal Protective Clothing and Equipment
AFR 92-1, Paragraph 4-14, Safety Equipment for Fire Fighters
AFR 127-4, Accident Reporting

B. OVERALL SAFETY RESPONSIBILITY

HQ AFESC/RDCF, as Test Director, is responsible for enforcing the overall safety program for the test. The Test Director or his designated representative will act as the Safety Officer during all tests and all other events at the test site. The Test Director will maintain close coordination with the AFESC Safety Officer and the Base Ground Safety Officer at the other Air Force test locations discussed in the test plan on all safety matters.

C. GENERAL SAFETY

1. Safety Briefing. The Test Director will brief all test personnel on known safety hazards associated with this test and test site. Supervisors will, in turn, brief their personnel on these hazards.

2. Visitors. Visitors will be permitted at the test site only with the approval of the Test Director. Visitors will be instructed on applicable safety regulations.

3. Individual Safety Responsibility. Careful attention to potential hazards associated with fire testing must be stressed at all levels of responsibility. The purpose of the safety rules outlined herein is to present the most important elements in experimenting with controlled fires. These rules do not cover all the possible hazards which may occur at the site. As new problems arise, new safety measures must be established. This Safety Plan must be strictly adhered to by all personnel and enforced by all supervisors. The procedures outlined in the plan shall be accepted as minimum safe conduct. Only the Test Director, with the concurrence of the AFESC Safety Officer, may authorize a deviation from this plan.

4. First Aid. An adequate supply of first-aid items will be maintained at the site. These items will be properly stored and periodically inspected. All personnel will be briefed upon the locations of first aid kit/supplies.

5. Accident Reporting (Emergency).

a. Scope. The purpose of this procedure is to ensure expedient handling and care of personnel injured in an accident or disaster. All post-emergency reporting and investigation of an accident will be performed in accordance with applicable Air Force Regulations.

b. Responsibility. Each person involved in this program must be familiar with the emergency reporting procedures established by this plan and immediately implement these procedures in the event of an accident. The Test Director will insure that all supervisors and subordinates are familiar with this procedure.

c. Emergency Reporting Procedures. In the event of an accident at the test site, the following procedures will be followed:

(1) The Test Director will direct appropriate first aid. Caution will be exercised to prevent aggravation of an accident-related injury.

(2) The Tyndall, or other Air Force Test Site Base Hospital Ambulance Service will be notified by calling extension 911, or other appropriate emergency extension. The nature of the accident, including apparent condition of injured personnel and the location of the test site, will be reported to the medical personnel. The Test Director will decide whether to transfer the injured directly to a hospital or to request emergency ambulance support.

(3) The Test Director will determine the seriousness of the accident. If the accident is not serious enough to require emergency hospitalization or ambulance service, the injured person will be taken to a doctor or hospital by normal means of transportation.

(4) All accidents requiring emergency treatment or first aid must be reported to the Safety Officer or the Safety NCO.

D. FIRE PREVENTION, REPORTING, AND EMERGENCY PROCEDURES

This paragraph defines the responsibility for fire prevention and reporting procedures related to the test.

1. Responsibility. The Test Director will be responsible for the implementation of the procedures established by this plan. All on-site personnel must be completely familiar with these procedures to ensure proper response to an emergency.

2. Fire Prevention Procedures. In an effort to reduce chances of an uncontrolled fire, portable fire extinguishers will be located at the test site, and all personnel participating in the fire test will be briefed on their locations and proper use thereof. Personnel will promptly report all fires to the Base Fire Department via the 911, or other in-use emergency extension.

ANNEX L

SAFECOMP INSTALLATION AND INSPECTION PROCEDURES

A. GENERAL

At each test location identified under Phase II testing procedures, the civil engineering craftsman and the computer facility manager, assisted by the AFESC/RDCF Test Director, will install SAFECOMP units and receiver/transmitter units as described below.

The computer facility manager, the fire chief, and the Base DEM will be notified a minimum of 10 days before the test start date concerning all base support requirements by the AFESC Test Director. Subsequent to this notification these individuals will coordinate the installation date with fire alarm technicians, fire inspectors, and the facility manager. They will provide interconnection of the SAFECOMP receiver/ transmitter to the building supervisory fire alarm system, to include 115 volt electrical wiring. Interface with the supervisory fire alarm system may be provided through a smoke detector circuit.

CAUTION: Interconnection should not allow activation of the Total Flood system after installation.

B. SPECIFIC INSTALLATION INSTRUCTIONS

1. Fire alarm technician will make interconnection in accordance with appropriate electrical codes and the manufacturers installation instruction sheet contained in Figure L-1 and test system after installation.

C. POST INSTALLATION AND 3-MONTH INSPECTION PROCEDURES

The computer facility manager and fire alarm technician will:

1. Inspect the SAFECOMP system every 3 months to determine its status as follows:

a. Insure the SAFECOMP unit and receiver/transmitter are in place.

b. Place the receiver/transmitter in " TEST" mode.

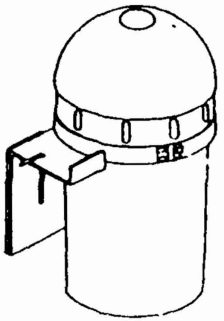
c. Move safety switch on the SAFECOMP unit to the "OFF" position and depress the detector test button. After a few seconds the unit will sound the alarm but will not discharge the Halon.

d. Record the status and alarm condition of the receiver/transmitter unit on the data sheet provided in Annex M.

NOTE: 1-2 seconds for status light (Green to Red).
14-16 seconds for alarm status light (Red).

e. Return receiver/transmitter to "NORM".

INSTALLATION INSTRUCTIONS – FIRE DETECTION & SUPPRESSION ASS'Y



CAUTION:

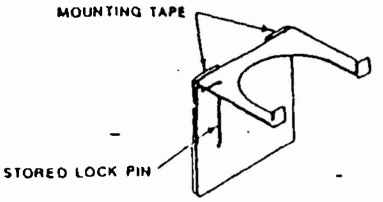
UNIT CONTAINS ELECTRICALLY ACTIVATED EXPLOSIVE TYPE CARTRIDGE. FOR INITIAL INSTALLATION AND RECHARGE KIT INSTALLATION, EYE PROTECTION AND 'REACH AROUND' PROTECTIVE BARRIER ARE RECOMMENDED TO PREVENT INJURY.

NOTE: DEPRESSING SMOKE DETECTOR FOR LONGER THAN 12 TO 14 SECONDS WILL ACTIVATE UNIT AND EXPEL EXTINGUISHING AGENT (HALON 1211).

ATTENTION:

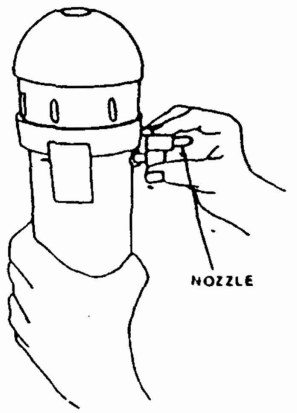
READ CAUTION AND ALL INSTALLATION INSTRUCTIONS THOROUGHLY BEFORE INSTALLING OR RECHARGING.

FIG. 1 INITIAL INSTALLATION FIG. 1 thru 4



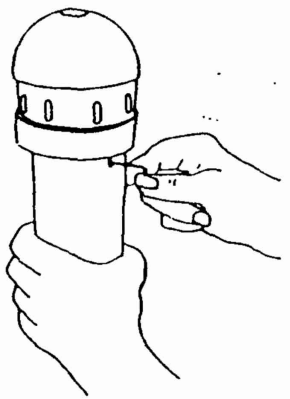
REMOVE BACKING PAPER FROM 'LOOP' TAPE ON MOUNTING BRACKET. LEAVING BOTH TAPE HALVES JOINED, LOCATE MOUNTING BRACKET IN DESIRED LOCATION AND PRESS FIRMLY. REMOVE MOUNTING BRACKET LEAVING 'LOOP' TAPE TO INSURE MAXIMUM BONDING OF ADHESIVE. PLACE MOUNTING BRACKET AGAINST TAPES, PRESS FIRMLY TO SECURE BRACKET.

FIG. 2



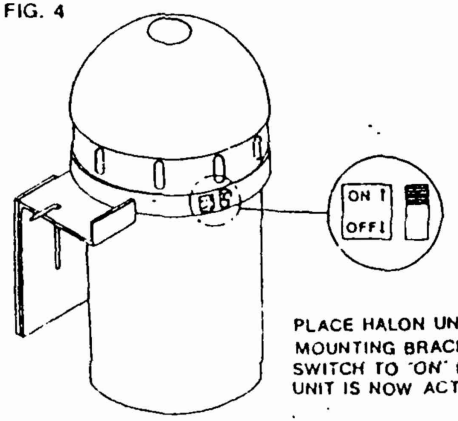
ADJUST SPRAY NOZZLE ON HALON UNIT TO DESIRED SPRAY DIRECTION.

FIG. 3

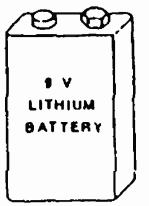


REMOVE STICK-ON LABEL AND PULL OUT SAFETY LOCK PIN. STORE PIN IN HOLE LOCATED IN MOUNTING BRACKET. SEE FIG. 1

FIG. 4



PLACE HALON UNIT IN MOUNTING BRACKET, MOVE SWITCH TO "ON" POSITION. UNIT IS NOW ACTIVATED



BATTERY REPLACEMENT:

WHEN THE BATTERY BEGINS TO WEAKEN, THE SMOKE DETECTOR ALARM SOUNDS A WARNING 'CHIRP' AT LEAST TWICE PER MINUTE FOR ABOUT A WEEK. REPLACE BATTERY WITH A 9V LITHIUM BATTERY.

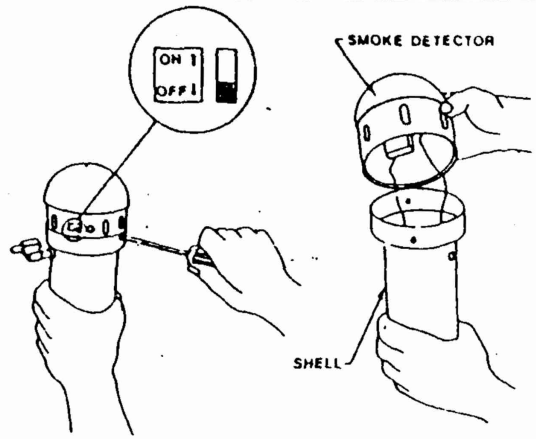
MAINTENANCE:

UNIT SHOULD BE INSPECTED EVERY SIX (6) MONTHS TO INSURE A FULL CHARGE OF EXTINGUISHING AGENT (HALON 1211) IS PRESENT. A UNIT CONTAINING A FULL CHARGE WILL WEIGH APPROX. 2.25 LBS.. AN EMPTY UNIT WILL WEIGH APPROX. 1.25 LBS..

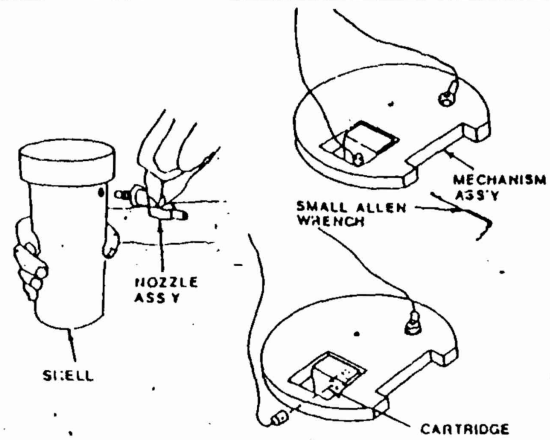
RECHARGE KIT INSTRUCTION INFORMATION ON OPPOSITE SIDE.

Figure L-1. Manufacturers SAFECOMP Installation Instructions

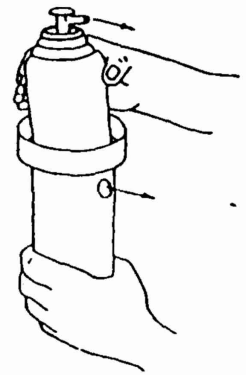
INSTALLATION INSTRUCTIONS - FIRE DETECTION & SUPPRESSION ASS'Y



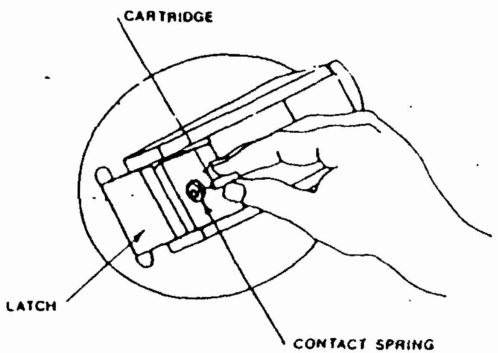
MOVE SWITCH TO OFF POSITION. REMOVE (3) #6 SCREWS AND SEPARATE SMOKE DETECTOR ASS'Y FROM SHELL.



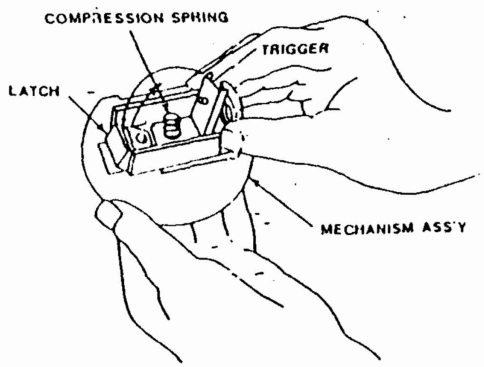
REMOVE NOZZLE ASS'Y TO ALLOW REMOVAL OF MECHANISM ASS'Y FROM SHELL. DISCONNECT WIRE FROM CARTRIDGE USING SMALL ALLEN WRENCH.



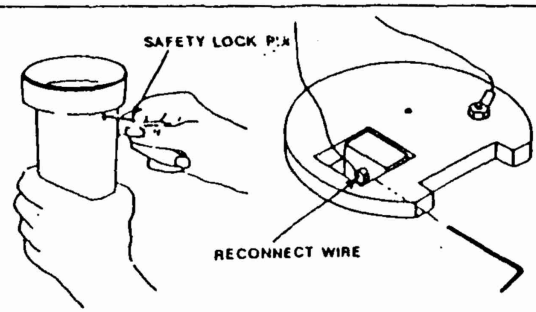
REPLACE EMPTY HALON 1211 CHARGE WITH NEW CHARGE, MAKE SURE NOZZLE POINTS TOWARD HOLE IN SHELL.



REMOVE AND DISCARD SPENT CARTRIDGE COMPONENTS. SLIDE NEW CARTRIDGE INTO CONTACT SPRING LOCATED IN LATCH.



MAKE SURE COMPRESSION SPRING IS ALIGNED IN POCKET, DEPRESS TRIGGER AND SWING LATCH INTO LOCKING POSITION WITH TRIGGER. CAREFULLY REPLACE MECHANISM ASS'Y INTO SHELL MAKING SURE TAPPED HOLE FOR NOZZLE ASS'Y ALIGNS WITH HALON CHARGE NOZZLE AND HOLE IN SIDE OF SHELL.



INSERT SAFETY LOCK PIN TO PREVENT ACCIDENTAL DISCHARGE OF HALON. REPLACE (1) #10 SCREW. MAKE SURE SWITCH IS IN OFF POSITION AND RECONNECT WIRING TO CARTRIDGE CONTACT. ASSEMBLY SMOKE DETECTOR ASS'Y WITH SHELL AND REPLACE (3) #6 SCREWS. REPLACE NOZZLE ASS'Y AND ADJUST TO DESIRED SPRAY POSITION. SEE FIG. 2. UNIT CAN NOW BE STORED OR PLACED IN SERVICE BY REMOVING SAFETY LOCK PIN AND MOVING SWITCH TO ON POSITION. SEE FIG. 4

Figure L-1. Manufacturers SAFECOMP Installation Instructions (concluded)

f. Check detector circuit (switch in "OFF" position on unit and receiver/transmitter in "NORM") record notification to fire alarm center and other programmed actions provided by the supervisory alarm system.

g. Return SAFECOMP unit safety switch to "ON" position. Return receiver/transmitter to "NORM".

h.. Weigh the SAFECOMP units and record the weight of the individual units on the data sheets provided in Annex M.

D. SAFECOMP ACTIVATIONS

In the event of a SAFECOMP activation the the computer facility manager and fire alarm technician will:

1. Record reason for activation, ie. fire, smoke, and source.

2. Recharge SAFECOMP IAW manufacturer's recharge instructions, contained in Figure L-1.

NOTE: A recharge unit will be provided to the fire alarm technician.

3. Record failures on the data sheet provided in Annex M and report to the AFESC/RDCF Test Director, CWO-4 Bobby Barrow, Autovon 523-6194.

ANNEX M

SAFECOMP DATA COLLECTIONS SHEETS

The following data collection sheets are provided for the hand-recording of all dat during the SAFECOMP DT&E/IOT&E.

SAFECOMP INITIAL RECEIVING INSPECTION DATA FORM
SAFECOMP FIRE TEST DATA FORM
SAFECOMP INSTALLATION DATA FORM
SAFECOMP INSPECTION AND RESERVICING REPORT
SAFECOMP ACTIVATION REPORT
SAFECOMP PERFORMANCE AND MAINTENANCE QUESTIONNAIRE

SAFECOMP INITIAL RECEIVING INSPECTION DATA FORM

Date of Inspection:_____ Inspector:_____ Unit #:_____

	S	U
1. Check shipping carton for installations instructions.	___	___
2. Check shipping carton for unit mounting bracket and insure bracket has hole for safety pin.	___	___
3. Weigh unit for proper weight and record.	___	___
_____ Full Weight 1050 grams (2.15 lb).		
_____ Empty Weight 611 grams (1.25 lb).		
4. Check for presence safety pin, proper installation in unit and secured with seal tape.	___	___
5. Check complete exterior of unit for damage.	___	___
6. Check condition of external power plug.	___	___
7. Insure discharge nozzle is secure and free of foreign objects.	___	___
8. check to insure on/off switch is secure and operational.	___	___
9. check condition and security of warning label on outside of system housing.	___	___
10. Perform complete interior inspection of unit to include: condition of wiring, loose connections, circuit board security, and freedom of corrosion.	___	___
11. Install 9 volt lithium battery and test unit. **CAUTION:** Do not hold test button down for more than 5 seconds. Depressing for more than 12 to 14 seconds will result in unit activation and the release of the agent.	___	___

S - Satisfactory
U - Unsatisfactory

Comments:

SAFECOMP FIRE TEST

DATA FORM

DATE:_____ TIME:_____

LOCATION:_____ NAME:_____

UNIT #:_____

INITIAL TEST:_____ RECHARGE TEST NUMBER: _____

ALCOHOL FIRE:_____ TRANSFORMER FIRE:_____

IGNITION TIME:_____ TRANSFORMER ON:_____

FIRST VISIBLE SMOKE:_____

FIRST VISIBLE FLAME:_____

SAFECOMP DETECTION TIME:_____(sounding alarm)

RECEIVER ACTIVATION TIME:_____(alarm red)

ALARM TIME: _____(alarm light)

HALON RELEASE TIME:_____

FIRE EXTINGUISH TIME:_____

REMARKS:

SAFECOMP INSTALLATION DATA FORM

DATE:_____ BASE:_____

LOCATION:_____ SITE SUPERVISOR:_____

UNIT #:_____ TECHNICIAN:_____

RECEIVER/TRANSMITTER #:_____

SAFECOMP INSPECTION AND RESERVICING REPORT

NOTE: Complete this form after the initial installation and at 3-month intervals thereafter.

DATE:_____ BASE:_____

LOCATION:_____ SITE SUPERVISOR:_____

UNIT #:_____ TECHNICIAN:_____

RECEIVER/TRANSMITTER UNIT:

1-2 seconds for status light (Green to Red). YES_____ NO_____

14-16 seconds for alarm status light (Red). YES_____ NO_____

WEIGHT OF SAFECOMP UNIT:

_____ Full Weight 1050 grams (2.15 lb).

_____ Empty Weight 611 grams (1.25 lb).

UNIT RESERVICED: YES_____ NO_____

SAFECOMP ACTIVATION REPORT

NOTE: In the event that a SAFECOMP unit is activated, either accidentally or to extinguish a fire, complete this form and notify the AFESC/RDCF Test director.

DATE:_____ BASE:_____

LOCATION:_____ SITE SUPERVISOR:_____

UNIT #:_____ TECHNICIAN:_____

ACTUAL FIRE:_____ FALSE ALARM:_____

HALON DISCHARGED: YES____ NO_____ FIRE EXTINGUISHED: YES____ NO_____

RECEIVER/TRANSMITTER UNIT ACTIVATED: YES____ NO_____

RECEIVER/TRANSMITTER UNIT NOTIFIED FIRE DEPARTMENT: YES____ NO_____

DATE/TIME UNIT RETURNED TO SERVICE:_____

SAFECOMP PERFORMANCE AND MAINTENANCE QUESTIONNAIRE

NAME:_____ JOB TITLE:_____

DATE:_____ LOCATION:_____

This form is to be completed by the Site Supervisor, Fire Chief, Fire alarm technicians, or any other personnel associated with the installation, repair, servicing, or operation of the SAFECOMP system during this evaluation period. This is a general questionnaire and should be completed after your association with the system is completed. It concerns the entire system, individual SAFECOMP units, the receiver/transmitter unit, and its interface with the facility supervisory alarm system.

Please answer any of these questions that apply to your association with the SAFECOMP system and add any comments that you wish. Any information that you provide will be useful and will effect the decision to buy the SAFECOMP system for world-wide Air Force use or not.

Please rate the following questions on a 1 to 4 basis, with 1 being the most desirable and 4 being the least desirable. Add any comments that you feel are appropriate.

1. Was the technical data provided by the manufacturer clear and concise?

   YES 1 2 3 4 NO

2. Were the installation and operational procedures easy to understand?

   YES 1 2 3 4 NO

SAFECOMP EXTINGUISHER UNIT

3. Was the SAFECOMP unit mounting bracket easy to install?

   YES 1 2 3 4 NO

4. Did the unit fit the mounting bracket?

   YES 1 2 3 4 NO

5. Did the battery fit the unit easily?

YES 1 2 3 4 NO

6. Was the Halon cylinder easy to replace?

YES 1 2 3 4 NO

7. Was the squib easy to replace?

YES 1 2 3 4 NO

8. Were there any other problems concerning the maintenance of the unit not mentioned in the previous questions? Please comment in this space.

RECEIVER/TRANSMITTER UNIT

9. Was the receiver/transmitter unit easy to install?

YES 1 2 3 4 NO

10. Did the test switch function properly?

YES 1 2 3 4 NO

SYSTEM PERFORMANCE

11. Did the unit(s) detect a fire if present?

YES 1 2 3 4 NO

12. Did the alarm operate properly?

YES 1 2 3 4 NO

APPENDIX B

SAFECOMP PHASE II FIELD TEST

TRIP REPORTS

This annex contains the trip reports covering the field installation and Phase II testing at Computer-Electronic facilities at seven Air Force installations within CONUS. Attachments have been deleted in the interest of brevity, but are available from the project officer. Trip reports are included for the following installations:

Gunter AFB, Alabama

Cheyenne Mountain AFB, Wyoming

Powell AFS, Wyoming

Lowry AFB, Colorado

USAFA, Colorado

Tyndall AFB, Florida

Eglin AFB, FLorida

FROM: HQ AFESC/RDCF 16 Nov 88

SUBJECT: Trip Report; SAFECOMP Initial Operational Test and Evaluation (IOT&E) at Data Processing Room, Standard System Center, Gunter AFB AL.

TO: HQ AFESC/RDC/RD

1. PURPOSE: To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. TRAVELER(s): CWO-4 B. F. Barrow, Test Director, HQ AFESC/RDCF and Mr. Robert E. McGill, HQ AFESC/YEL Tyndall AFB FL.

3. ORGANIZATION(s): 3800 Air Base Wing/Civil Engineering Squadron (AU)
HQ Standard System Center (AFCC)

a. Key Contacts: 3800 ABW/DE, CMS Evans, Fire Chief, SSgt Allard, Assistant Fire Chief/Technical Services, Mr Warren and Mr Josey, Fire Alarm Technicians. Autovon: 875-5484 (DEF), 446-3467 (DEM) HQ SSC - CMS Blair (SSO) and SSGT Stagg (SSOO): HQ SSC/AQAE - Mr Flint. Autovon 446-33324 or 4736.. Reference attachments 1 & 2.

b. Observations: At the Computer Data Room, Standard System Center, Bldg. 857, installed 5 SAFECOMP Units with a Receiver/Transmitter (RT) interfaced with the supervisory fire alarm system. The decision was made to use the Standard System Center as the IOT&E Test Bed. The installation and checkout phase of IOT&E was between 14-16 Nov 88. Reference attachments 3 & 4.

4. Outcome/Conclusion(s): The environmental conditions of the Data Processing Center are typical of large Computer Data Rooms. The controlled temperature range and moderate background noise levels will present interesting challenges for the SAFECOMP System. A bank of Honeywell ADPE consisting of two Central Processing Units, two Central Memorys, and a MTP Controller was selected for protection. The Computer Data Room is currently protected by total flood Halon 1301 Fire Suppression System and a Cross-Zoned Smoke Detection System. The SAFECOMP System works independently of these two systems.

5. Recommendation(s): The Gunter AFB Fire Department, Technical Services will collect the IOT&E data. The Fire Alarm Technician will assist the HQSSC/SSO personnel with the required IOT&E mid-point inspection and test of the SAFECOMP System, due 15 Feb 89. HQ AFESC will return early Jun 89 to complete the six month IOT&E and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation.

B.F. BARROW, CWW04 USAFR
Project Manager/Test Director

5 atch
1. Start-up Meeting
2. SAFECOMP Training
3. Initial Inspection
4. SAFECOMP Installation
5. Out-Briefing

cc: HQ AU/DEF
HQ AFCC/DEMM
HQ SSC/SSO
HQ SSC/AQAE
3800 ABW/DEFT
3800 ABW/DEM

FROM: HQ AFESC/RDCF 23 Nov 88

SUBJ: Trip Report: SAFECOMP Initial Operational Test and Evaluation (IOT&E) at Cheyenne Mountain AFB CO.

TO: HQ AFESC/RDC/RD

1. PURPOSE: To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. TRAVELER (S): CWO-4 B.F. Barrow, Test Director, HQ AFESC, Tyndall AFB FL.

3. ORGANIZATION (S): 1010 Civil Engineering Squadron
47 Communication Group (AFCC)

a. Key Contacts: 1010 CES/DE, Lt Col G.G. Hamill, Commander, MSgt Mike Kavanaugh, Fire Chief, TSgt Edgar Lane, Assistant Fire Chief/Technical Services, SSgt Donald Wilson, Fire Alarm Technician, Autovon: 834-1211-3030 (DEF) and 834-1211-3523 (DEMIC). 47CG/DON - TSgt James E Schmidt, Chief of Communication Operations, Autovon 834-1211-3869. Reference attachments 1 & 2. Foxbro Systems , Mr. Rod Fox, Phone (719) 597-8939.

b. Observations: At the Digital Display System Maintenance Center (DDSMC) (Room 2209), Building 2000, installed 4 SAFECOMP Units with a Receiver/transmitter (RT) interfaced with supervisory fire alarm system. The decision was made to use the Digital Display System Maintenance Center as the IOT&E Test Bed. The installation and checkout phase of IOT&E was 21-23 Nov 88. Reference attachments 3 & 4.

4. OUTCOME/CONCLUSTION (S): The environmental conditions of the DDSMC are typical of Computer Data Rooms. The low humidity and high elevation experienced at Cheyenne Mtn AFB will present unique opportunity in evaluating SAFECOMP. The controlled temperature range and moderate background noise levels will present interesting challenges for the SAFECOMP System, but should not prevent the SAFECOMP 85 DBM audible warning signal from activating the RT. The Graphic Display console, Data General 1220 Computer and the Audio Video Switch Matrix were selected for Protection. The DDSMC is currently protected by a Smoke Detection System. The SAFECOMP System was interfaced with a smoke detector circuit which transmitted the alarm condition to the Fire Department Alarm Center.

5. RECOMMENDATION (S) : The Cheyenne Mountain Fire Department, Technical Services Section will collect the IOT&E data. The Fire Alarm Technician will assist the 47 GG/DO personnel with the required IOT&E mid-point inspection and test of the SAFECOMP System due 23 Feb 89. HQ AFESC will return early Jun 89 to complete the six month IOT&E and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation.

B. F. BARROW, CWO-4, USAFR
Project Manager/Test Director

5 Atch
1. Start-up Meeting
2. SAFECOMP Training
3. Initial Inspection
4. SAFECOMP Installation
5. Out-Briefing

cc: HQ AFSPACECOM/DEMP
HQ AFCC/DEMM
1010 CES/DEF
1010 CES/DEM
47 CG/DO

FROM: HQ AFESC/RDCF 1 Dec 88

SUBJECT: Trip Report; SAFECOMP Initial Operational Test and Evaluation (IOT&T) at Det 16, 1 CEVG (SAC) Strategic Training Range (STR), Powell WY

TO: HQ AFESC/RDC/RD

1. Purpose: To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. Traveler(s): CWO-4 B. F. Barrow, Test Director, HQ AFESC, Tyndall AFB FL; MSgt Guadalupe Briones, 1 CEVG/SE, Barksdale AFB LA; TSgt Clara L. Santopietro, 341 CES/DEM, and TSgt R. D. Thayer, 341 CES/DEF, Malstrom AFB MT.

3. Organization(s): Detachment 16, 1 CEVG (SAC), Powell WY.

a. Key Contacts: Detachment 16 - Lt Col Jerome S. Pauley, Commander, Maj Alexander A. Dolega, Jr., Operations Officer, SMSgt Wayne M. Curry, Chief of Maintenance, TSgt Ross M. Peterson, AN/MPS-9 Workcenter Supervisor. AUTOVON: 632-3437/8. Reference attachments one and two.

b. Observations: At Detachment 16, installed five SAFECOMP units with a Receiver/Transmitter interfaced with the supervisory fire alarm system. The decision was made to use the AN/MPS-9 van as the IOT&E test bed. Reference attachments three and four. The installation and checkout phase of IOT&E was between 28 Nov - 2 Dec 88.

4. Outcome/Conclusion(s): The environmental conditions of the AN/MPS-9 van is quite different than other IOT&E select Air Force locations. The wide temperture ranges, high RF transmissions, and high background noise levels will present interesting challanges for the SAFECOMP system. The Powell site remote location from Malmstrom AFB (Host Support Base) requires the Detachment 16 personnel to maintain and collect data during the IOT&E that would normally be the Base Fire Departments function. A heating/air conditioner (HAC) unit located in the front section of the van has a background noise level exceeding 100 decibels (dbm) when operating and will prevent the SAFECOMP 85 dbm audible warning signal from activating the receiver/transmitter in some SAFECOMP unit locations. The HAC is only operated when the van is manned and is not operated even than continuously.

5. Recommendations(s): Malmstrom AFB Fire Department and Fire Alarm Technician assist Detachment 16 with the required IOT&E mid-point inspection and test of the SAFECOMP system due 28 Feb 89. HQ AFESC and 1 CEVG/SE return first of June 89 to complete the six month IOT&E with Detachment 16 and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation.

B. F. BARROW, CWO-4, USAFR
Project Manager/Test Director

5 Atch
1. Start-up Meeting
2. SAFECOMP Training
3. Initial Inspection
4. SAFECOMP Installation
5. Out-briefing

cc: HQ SAC/DEMF
Det 16, 1 CEVG
HQ 1 CEVF/SE
341 CES/DEF
341 CES/DEM

FROM: HQ AFESC/RDCF 6 Dec 88

SUBJECT: Trip Report; SAFECOMP Initial Operational Test and Evaluation (IOT&E) at Data Processing Center, Lowry Technical Training Center Center, Lowry AFB CO

TO: HQ AFESC/RDC/RD

1. **PURPOSE:** To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. **TRAVELER(s):** CWO-4 B.F. Barrow, Test Director, HQ AFESC, Tyndall AFB FL.

3. **ORGANIZATION(s):** 3415 Civil Engineering Squadron
1987 Communication Squadron

a. **Key Contacts:** 3415 ABG/DE, Lt Col P.J. Toussaint, Commander, Mr W.F. Bennyhoff, Fire Chief, MSgt Jimmie R. Pea, Deputy Fire Chief, Mr Jasper N. Page and SSgt J.D. Stille, Fire Alarm Technicians. Autovon: 926-2408 (DEF), 926-41-1 (DEMCB)
1987 CS/DD, Capt T. Cooley, DO, Mr Paul J. Austin, DOO, ADPE Director of Operations, and TSgt Jon A. Gallegos, DOOO, ADPE Chief of Operations Autovon 926-5310. Reference attachments 1 & 2.

b. **Observations:** At the Computer Date Room, Data Processing Center, Bldg 385, installed 5 SAFECOMP Units with a Receiver/Transmitter (RT) interfaced with the supervisory fire alarm system. The decision was made to use the Data Processing Center as the IOT&E Test Bed. Reference attachments 3 & 4. The installation and checkout phase of IOT&E was between 5-7 Dec 88.

4. **Outcome/Conclusion(s):** The environmental conditions of the Data Processing Center are typical of Computer Data Rooms. The controlled temperature range and moderate background noise levels will present interesting challenges for the SAFECOMP System. A bank of SPERRY UNIVAC ADPE consisting of a Central Processing Unit, Communications Processor, Disc Unit and Disc Controller was selected for protection. A heating/air conditioner (HAC) unit located in the front section of the room has a high background noise level when operating, but should not prevent the SAFECOMP 85 dbm audible warning signal from activating the RT. The Computer Data Room is currently protected by total flood Halon 1301, Fire Suppression System and a Cross-Zoned Smoke Detection System. The SAFECOMP System works independently of these two systems.

5. **Recommendation(s):** The Lowry AFB Fire Department, Technical Services will collect the IOT&E data. The Fire Alarm Technician will assist the 1987 CS/DOOO personnel with the required IOT&E mid-point inspection and test of the SAFECOMP System, due 6 Mar 89. HQ AFESC will return early Jun 89 to complete the six month IOT&E and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation.

B.F. BARROW, CWO-4, USAFR
Project Manager/Test Director

5 Atch
1. Start-up Meeting
2. SAFECOMP Training
3. Initial Inspection
4. SAFECOMP Installation
5. Out-briefing

cc: ATC
HQ ATC/DEMF
HQ AFCC/DEMM
3415 ABG/DEF
3415 ABG/DEM
1987 CS/DO

FROM: HQ AFESC/RDCF 8 Dec 88

SUBJ: Trip Report; SAFECOMP Initial Operational Test and Evaluation (IOT&E) at Data Processing Center, US Air Force Academy, Colorado Springs CO

TO: HQ AFESC/RDC/RD

1. PURPOSE: To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2 TRAVELER(S): CWO-4 B. F. Barrow, Test Director, HQ AFESC, Tyndall AFB FL.

3. ORGANIZATION(S): 7625 Civil Engineering Squadron
1876 Communication Group (AFCC)

a. Key Contacts: 7625 CES/DE, Col W. R. Stallworth, Commander, Mr W. C. Hartshorn, Fire Chief, Mr J. C. Scherb, Assistant Fire Chief/Technical Services, Mr D. A. Krause, Fire Alarm Technician. Autovon: 259-2051 (DEF) and 259-4655 (DEMM-7).
1876 CG/DON-MSgt Ronald E. Sellers, Chief of Communication Operations. Autovon: 259-4700. Reference attachments 1 & 2.
Colorado Burglar/Fire Alarm-Mr Tim Schlis. Phone: (719) 574-2368.
Sperry Field Engineer Representatives-Mr H. Lewis and Mr Larry Sutton. Autovon: 259-2628.

b. Observations: At the Computer Data Room, Data Processing Center, Bldg 4199, installed 4 SAFECOMP Units with a Receiver/Transmitter (RT) interfaced with supervisory fire alarm system. The decision was made to use the Data Processing Center as the IOT&E Test Bed. The installation and checkout phase of IOT&E was 8-9 Dec 88. Reference attachments 3 & 4.

4. OUTCOME/CONCLUSION(S): The environmental conditions of the Data Processing Center are typical of Computer Data Rooms. The low humidity and high elevation experienced at the US Air Force Academy will present unique opportunity in evaluating SAFECOMP. The controlled temperature range and moderate background noise levels will present interesting challenges for the SAFECOMP System, but should not prevent the SAFECOMP 85 dbm audible warning signal from activating the RT. A bank of SPERRY UNIVAC ADPE consisting of a Central Processing Unit, Communications Processor, Communications Controller and Tape Controller was selected for protection. The Computer Data Room is currently protected by a total flood Halon 1301, Fire Suppression System and a Cross-Zoned Smoke Detection System. The SAFECOMP System works independently of these two systems.

5. RECOMMENDATION(S): The USAFA Fire Department, Technical Services section will collect the IOT&E data. The Fire Alarm Technician will assist the 1876 CG/DON personnel with the required IOT&E mid-point inspection and test of the SAFECOMP System, due 8 Mar 89. HQ AFESC will return early Jun 89 to complete the six month IOT&E and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation.

B. F. BARROW, CWO-4, USAFR
Project Manager/Test Director

5 Atch
1. Start-up Meeting
2. SAFECOMP Training
3. Initial Inspection
4. SAFECOMP Installation
5. Out-briefing

cc:
HQ USAFA/DE
HQ AFCC/DEMM
7625 CES/DEF
7625 CES/DEM
1876 CG/DO

FROM: HQ AFESC/RDCF 5 Jan 89

SUBJECT: Trip Report; SAFECOMP Initial Operational Test and Evaluation (IOT&E) at Data Processing Areas, Tyndall AFB FL.

TO: HQ AFESC/RDC/RD

1. PURPOSE: To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. TRAVELER(s): CWO-4 B. F. Barrow, Test Director, HQ AFESC/RDCF and CMSgt Earl E. Buckmaster, HQ AFESC/RDCF, Tyndall AFB FL.

3. ORGANIZATION(s): 325 CES/DEF(TAC), 83FWS/ADB(TAC) and HQ AFESC/SI

a. Key Contacts: 325CES/DEF, Mr John Stokes, Fire Chief, Mr Charlie Fox, Assistant Fire Chief/Technical Services; Mr Ed Norman and SSgt Plaz, Fire Alarm Technicians. Autovon: 523-2909 (DEF), 523-4634 (DEM)
HQ AFESC/SI - 1LT Kincaid, AV 523-6497: 83FWS/ADB, Capt Brill, AV 523-2271. Reference attachments 1 & 2.

b. Observations: At the AFESC WANG Center, Bldg 1120B, installed a SAFECOMP Unit, and at the 83FWS Analysis Branch, installed two safecomp units and a Receiver/Transmitter (RT) interfaced with the supervisory fire alarm system. The decision was made to use these two areas as the IOT&E Test Bed. The installation and checkout phase of IOT&E was 4 Jan 89. Prototype safecomp units installed 1 Nov 87 were replaced with 1st article units. These prototypes operated flawlessly for over fourteen months in an operational computer environment, and will provide valuable evaluation data for determining Measures of Effectiveness. ie. Mean Time to Repair (MTTR), and Mean Time Between Failure (MTBF).

4. Outcome/Conclusion(s): The environmental conditions of the data processing areas are typical of computer data rooms. The controlled temperature range and moderate background noise levels will present interesting challenges for the SAFECOMP System. Three central processing units were selected for protection. The computer rooms are currently protected by a smoke detection system. The SAFECOMP System was interfaced with a smoke detector circuit which transmitted the alarm condition to the fire department alarm center.

5. Recommendation(s): The Tyndall AFB Fire Department, Technical Services will collect the IOT&E data. The Fire Alarm Technician will assist with the required IOT&E mid-point inspection and test of the SAFECOMP System, due 4 Apr 89. HQ AFESC will complete the six month IOT&E and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation in Jul 89.

B.F. BARROW, CWO-4 USAFR
Project Manager/Test Director

2 atch
1. Inspection Report, Bldg 1801, Weapons Eval Center
2. Inspection Report, Bldg 1120B, HQ AFESC WANG Center

CC: HQ TAC/DEMF
325CES/DEF/DEM
83FWS/ADB

FROM: HQ AFESC/RDCF 10 Jan 89

SUBJECT: Trip Report; SAFECOMP Initial Operational Test and Evaluation (IOT&E) at Data Processing Areas, Eglin AFB FL.

TO: HQ AFESC/RDC/RD

1. **PURPOSE:** To implement SAFECOMP IOT&E by installing SAFECOMP (First-Article) production models at select Air Force locations participating with HQ AFESC in a six month IOT&E. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. **TRAVELER(s):** CWO-4 B. F. Barrow, Test Director, HQ AFESC/RDCF, Tyndall AFB, FL., and Mr Nick Angelo, Det 2, AFOTEC, Eglin AFB, FL.

3. **ORGANIZATION(s):** 3202 CES (AFSC).

a. **Key Contacts:** 3202 CES/DEF, Mr James D. Cooper, Fire Chief; Mr Jimmie Patterson, Assistant Fire Chief/Technical Services, Autovon: 872-5856 (DEF); 3202 CES/EMCS, Mr Wayne Butler, Fire Alarm Technician, 872-5880 (EMCS); MSgt Gilbert, 872-2778 (DEI). Reference attachment 1.

b. **Observations:** At the Civil Engineering WANG Center, Bldg 696, installed a SAFECOMP Unit and a Receiver/Transmitter (RT) interfaced with the supervisory fire alarm system. The decision was made to use this area as the IOT&E Test Bed. The installation and checkout phase of IOT&E was 10 Jan 89.

4. **Outcome/Conclusion(s):** The environmental conditions of the WANG Center is typical of computer data rooms. The controlled temperature range and moderate background noise levels will present interesting challenges for the SAFECOMP System. A central processing unit was selected for protection. The SAFECOMP System was interfaced with a smoke detector circuit which transmitted the alarm condition to the fire department alarm center.

5. **Recommendation(s):** The Eglin AFB Fire Department and Fire Alarm Technician will assist with the required IOT&E mid-point inspection and test of the SAFECOMP system due 10 Apr 89. HQ AFFESC will complete the six month IOT&E and return SAFECOMP to Tyndall AFB for the final phase of the Development Test and Evaluation in Jul 89.

B. F. BARROW, CWO-4, USAFR
Project Manager/Test Director

4 Atch
1. Start-up Meeting/Training
2. Initial Inspection
3. SAFECOMP Installation
4. Out-briefing

cc: HQ AFSC/DEMF
3202 CES/DEF/DEM/DEI

13 JAN 1989

RDCF

Trip Report: SAFECOMP Site Visit, Standard System Center, Gunter AFB AL

RDCF
RDC
RD
IN TURN

1. PURPOSE: To resolve SAFECOMP Development Test and Evaluation (DT&E) issue and to restore SAFECOMP System to service due to an equipment failure. Reference HQ AFESC "Test Plan" SAFECOMP Development Test and Evaluation/IOT&E.

2. TRAVELER(S): CWO-4 B. F. Barrow, Test Director, HQ AFESC/RDCF.

3. ORGANIZATION(S): 3800 Air Base Wing/Civil Engineering Squadron (AU)
HQ Standard System Center (AFCC)

a. Key Contacts: 3800 ABW/DEFT, SSgt Allard, Assistant Fire Chief/Technical Services, Mr Warren, Fire Alarm Technicians. AUTOVON: 875-5484 (DEF), 446-3467 (DEM) HQ SSC/SSO, CMS Blair. AUTOVON: 446-3324.

b. Observations: A SAFECOMP Activation Report (Attachment 1) was filed 3 Jan 89 by the Gunter AFB Fire Department. The SAFECOMP units involved were installed 14 Nov 88 as part of a DT&E/IOT&E at the Standard System Center, Bldg 857.

4. OUTCOME/CONCLUSION(S): Cause of activation was due to an equipment failure (hanger bracket). The adhesive backing on the bracket failed on day 50 of the IOT&E, causing the SAFECOMP unit to fall. Impact of the fall caused the unit to alarm; notify the Fire Department; and discharge the Halon 1211 fire extinguishing content. Fire Department investigation revealed that 4 out of 5 brackets used to hold the SAFECOMP units inside the computer cabinets had failed due to the adhesive backing, fastening the brackets to the computer cabinent metal interior walls. Gunter Fire Department requested HQ AFESC assistance to resolve the bracket failure and restore the SAFECOMP System to service. Prior to departure, the test director consulted with Tyndall Medical Maintenance concerning an Adhesive Cynanoacrylate (Super Glue) NSN 8040-00-142-9193 they use to hold medical equipment in place. This adhesive eliminates need for bolt or screw fasteners, which cannot be used in the computer cabinets. A test was conducted by applying several beads of super glue on each bracket's adhesive strips and reapplying the bracket to a metal surface.

Application for remounting the bracket was fast (15 seconds bonding and approximately 5 minutes for set-up) and successfully withstood weight 10X the SAFECOMP's 2.5 pounds. On 11 Jan 89 SAFECOMP System at Gunter AFB was restored to service using the above fix.

5. RECOMMENDATIONS: Fire Department Inspectors or point of contacts at other test sites participating in the IOT&E have been asked to reapply brackets using the above repair method and report findings to the test director. An interesting finding of this equipment failure was that the SAFECOMP System functioned properly upon activation ie., alarmed, notified the Fire Department and discharged the extinguisher contents. The SAFECOMP System was easily restored to service after the bracket failure was fixed and is considered a non-critical equipment failure.

B. F. Barrow

B. F. BARROW, CWO-4, USAFR
Test Director/Program Manager

Atch: Report